N00158.AR.000251
NAS WILLOW GROVE
5090.3a

# QUALITY ASSURANCE PROJECT PLAN for TEST PIT INVESTIGATION

# SITE 3 - NINTH STREET LANDFILL

## NAVAL AIR STATION JOINT RESERVE BASE WILLOW GROVE, PENNSYLVANIA

**Naval Facilities Engineering Command Mid-Atlantic**

Contract No. N62472-03-D-0057
Contract Task Order 003

APRIL 2007

TETRA TECH NUS, INC.

**TETRA TECH** NUS, INC.
600 Clark Avenue, Suite 3 • King of Prussia, PA 19406-1433
Tel 610.491.9688 • Fax 610.491.9645 • www.tetratech.com

2192-2.1-007

PHIL-21045

May 8, 2007

Project Number 2192

Base Realignment and Closure
Program Management Office, Northeast
4911 South Broad Street
Philadelphia, Pennsylvania 19112-1303

Attn: Mr. Curtis Frye

Reference: Contract No. N62472-03-D-0057
Contract Task Order (CTO) No. 003

Subject: Submission of Final Quality Assurance Project Plan (QAPP) Site 3 Test Pits
NAS JRB Willow Grove, Pennsylvania

Dear Mr. Frye:

Tetra Tech NUS, Inc. (Tetra Tech) is pleased to provide copies of the subject Final QAPP for Site 3 Test Pits at NAS JRB Willow Grove. Four copies have been sent to Lisa Cunningham at EPA Region 3, two copies have been sent to April Flipse at PADEP, one copy has been sent to Jim Edmond at NAS JRB Willow Grove, one copy has been sent to the Executive Officer NAS JRB Willow Grove, and three are enclosed for your use.

Each recipient named has also received an electronic copy of the document on compact disk (CD). One bound copy plus one copy on CD have been sent to Laurie Tynan at the Horsham Township Public Library for inclusion in the Administrative Record.

Thank you for this opportunity to submit the corrected documents. Do not hesitate to contact me if you have any questions or require revisions.

Sincerely,

Russell E. Turner
Project Manager

RET/vh

Enclosure

c: Lisa Cunningham (EPA Region 3)
April Flipse (PADEP)
Jim Edmond (NAS JRB Willow Grove)
Executive Officer (NAS JRB Willow Grove)
Laurie Tynan (Horsham Township Public Library)
Garth Glenn (TtNUS) (without enclosures)
File

PHIL-20959

# QUALITY ASSURANCE PROJECT PLAN
for
TEST PIT INVESTIGATION

## SITE 3 - NINTH STREET LANDFILL

## NAVAL AIR STATION JOINT RESERVE BASE
## WILLOW GROVE, PENNSYLVANIA

## COMPREHENSIVE LONG-TERM
## ENVIRONMENTAL ACTION NAVY (CLEAN) CONTRACT

Submitted to:
Naval Facilities Engineering Command Mid-Atlantic
9742 Maryland Avenue
Norfolk, Virginia 23511-3095

Submitted by:
Tetra Tech NUS, Inc.
600 Clark Avenue, Suite 3
King of Prussia, Pennsylvania 19406-1433

Contract No. N62472-03-D-0057
Contract Task Order 003

April 2007

PREPARED UNDER DIRECTION OF:

Russell E. Turner

RUSSELL E. TURNER
PROJECT MANAGER
TETRA TECH NUS, INC
KING OF PRUSSIA, PENNSYLVANIA

APPROVED FOR SUBMISSION BY:

Kelly A. Carper

KELLY A. CARPER
QUALITY ASSURANCE MANAGER
TETRA TECH NUS, INC.
PITTSBURGH, PENNSYLVANIA

# TABLE OF CONTENTS

## TABLE OF CONTENTS (Continued)

## LIST OF ACRONYMS

| | |
|---|---|
| %R | Percent Recovery |
| CLEAN | Comprehensive Long-term Environmental Action Navy |
| COC | Chain of Custody |
| CTO | Contract Task Order |
| DOD QSM | Department of Defense Quality Systems Manual |
| DVM | Data Validation Manager |
| FOL | Field Operations Leader |
| GC/MS | Gas Chromatography/Mass Spectrometry |
| GIS | Geographical Information System |
| ICP | Inductively Coupled Plasma |
| IDW | Investigation-Derived Waste |
| LCSs | Laboratory Control Samples |
| LQAP | Laboratory Quality Assurance Plan |
| MDLs | Method Detection Limits |
| MPC | Measurement performance criteria |
| MSDs | Matrix Spike Duplicates |
| MS | Matrix Spike |
| NA | Not Applicable |
| NAS JRB | Naval Air Station Joint Reserve Base |
| NAVFAC | Naval Facilities Engineering Command |
| NELAP | National Environmental Laboratory Accreditation Program |
| NFESC | Naval Facilities Engineering Service Center |
| NR | Not Recorded |
| OSHA | Occupational Safety and Health Administration |
| PADEP | Pennsylvania Department of Environmental Protection |
| PARCCS | Precision, Accuracy, Representativeness, Comparability, Completeness, Sensitivity |
| PCB | Polychlorinated Biphenyl |
| PDSs | Post-digestion Spikes |
| PM | Project Manager |
| PPE | Personal Protective Equipment |
| PQOs | Project Quality Objectives |
| QA | Quality Assurance |
| QAPP | Quality Assurance Project Plan |
| QC | Quality Control |

## LIST OF ACRONYMS (Continued)

| | |
|---|---|
| QL | Quantitation Limit |
| RBC | Risk-based Concentration |
| RI | Remedial Investigation |
| RPD | Relative Percent Difference |
| RSD | Relative Standard Deviation |
| SDG | Sample Delivery Group |
| SOPs | Standard Operating Procedures |
| SVOC | Semivolatile Organic Compound |
| TtNUS | Tetra Tech NUS, Inc. |
| UFP-QAPP | Uniform Federal Policy for Quality Assurance Project Plans |
| USEPA | United States Environmental Protection Agency |
| U.S. Navy | United States Navy |
| VOC | Volatile Organic Compound |
| WP | Work Plan |

# 1.0 PROJECT MANAGEMENT AND OBJECTIVES

This Quality Assurance Project Plan (QAPP) for a test pit investigation at Site 3 at the Naval Air Station Joint Reserve Base (NAS JRB) Willow Grove, Pennsylvania, has been prepared by Tetra Tech NUS (TtNUS) on behalf of the United States Navy (U.S. Navy) Naval Facilities Engineering Command Mid-Atlantic (NAVFAC Mid-Atlantic) under the Comprehensive Long-term Environmental Action Navy (CLEAN) Contract Task Order No. 003 under Contract N62472-03-D-0057. The QAPP contained herein was generated for and will comply with applicable Uniform Federal Policy for Quality Assurance Project Plans (UFP-QAPP), and United States Environmental Protection Agency (USEPA) Region 3 requirements, regulations, guidance, and technical standards as appropriate.

This QAPP outlines the organization, project management and objectives, planned activities, measurement/data acquisition, assessment/oversight, and data review procedures associated with the test pit and soil sampling to be conducted at Site 3 at the NAS JRB Willow Grove, Pennsylvania. This QAPP specifies requirements for fieldwork related to the collection of soil samples from the excavation of test pits located at Site 3 to supplement the Remedial Investigation (RI) for the Ninth Street Landfill site (Site 3).

Protocols for sample collection, handling, and storage, chain-of-custody, laboratory and field analyses, data validation, and reporting are also addressed in this QAPP.

The investigation procedures utilized will comply with TtNUS Standard Operating Procedures (SOPs), which are included in Appendix A of this QAPP.

The fieldwork and sampling are scheduled to begin in April 2007. A complete schedule is detailed in the Work Plan (WP) for Test Pit Investigation (TtNUS, 2007) in Section 1.3.

Information on site background can be found in the WP (TtNUS, 2007). Additional site information and analytical results for previous sampling rounds were reported in the RI reports for the Ninth Street Landfill (HNUS, 1993 and Brown and Root, 1997).

Figure D-1 is the site map for NAS JRB Willow Grove Site 3 - Ninth Street Landfill and depicts the site-wide sampling locations. Figure D-1 is located in Appendix D. Figure 2-1 and 2-2 of the WP present the location of NAS JRB Willow Grove and the location of Site 3 within the base.

The field activities conducted under this QAPP shall meet the requirements of the NAS JRB Willow Grove Site-Specific Health and Safety Plan (TtNUS, 2007).

## 1.1 DOCUMENT FORMAT

### 1.1.1 Document Control Format

Document control procedures will be used to identify the most current version of the QAPP and to help ensure that only the most current version of the QAPP is used by all project participants. To meet this goal, text, tables, and figures in this QAPP include a header indicating the revision number and date. The footer indicates the page number within the section. Revision 0 with the month and year will be used as part of the header, for the draft, draft final and final versions. Any revisions made after submittal of the final will be indicated with appropriate revision number and date.

### 1.1.2 Document Control Numbering System

A document control numbering system will not be used for this QAPP because this project has a distinct document distribution list. The QAPP and any revisions, addenda, or amendments will be provided in accordance with the QAPP distribution list (see Section 1.2.1).

### 1.1.3 QAPP Identifying Information

The QAPP identifying information includes the key project players, previous site work, and the program for which the current project is being performed. The QAPP title and approval page is on Worksheet No. 1 and identifying information is provided on Worksheet No. 2. The UFP-QAPP worksheets are presented in Appendix B.

## 1.2 DISTRIBUTION LIST AND PROJECT PERSONNEL SIGN-OFF SHEET

### 1.2.1 Distribution List

The QAPP distribution list includes: Pennsylvania Department of Environmental Protection (PADEP), USEPA Region 3, U.S. Navy, and TtNUS. The distribution list for this QAPP is summarized in Worksheet No. 3. Each person listed in Worksheet No. 3 will receive a copy of this QAPP (Revision 0) and any subsequent revisions.

### 1.2.2 Project Personnel Sign-Off Sheet

Worksheet No. 4 provides an example of the project personnel sign-off sheet that will be signed by all personnel working on the project. A signature on this form indicates the person has read this QAPP and is familiar with the tasks to be performed. The completed sign-off sheet will be maintained in the TtNUS project file.

## 1.3 PROJECT ORGANIZATION CHART

A project organization chart depicting the personnel involved with the QAPP is shown in Worksheet No. 5. The U.S. Navy and TtNUS (Contractor) will implement this QAPP.

### 1.3.1 Communication Pathways

Pathways have been established to transfer information and to make alterations to project methods that may be required because of unforeseen circumstances. Communication pathways are depicted in Worksheet No. 6.

### 1.3.2 Personnel Responsibilities and Qualifications

Project personnel responsibilities and qualifications are displayed in Worksheet No. 7. Résumés of the TtNUS personnel listed in the worksheet are available upon request.

### 1.3.3 Special Training Requirements and Certifications

All field personnel will have received the appropriate training required to conduct the field activities to which they are assigned. Additionally, each site worker will be required to have completed a 40-hour course (and 8-hour refresher, if applicable) in Health and Safety Training as described under Occupational Safety and Health Administration (OSHA) 29 CFR 1910.120(b)(4). This training is documented on Worksheet No. 8.

The selected analytical laboratory, STL Laboratories, has successfully completed the laboratory evaluation process required as part of the Naval Facilities Engineering Service Center (NFESC) Quality Assurance Program and described in the Department of Defense Quality Systems Manual (DOD QSM) (January 2006) and is additionally certified by the National Environmental Laboratory Accreditation Program (NELAP), which is the recognized certifying authority for the state of Pennsylvania.

## 1.4 PROJECT PLANNING AND PROBLEM DEFINITION

This section summarizes information on the project planning conducted to develop the problem definition. This section also includes site history and background information.

### 1.4.1 Project Planning

Project planning meetings via conference calls and meetings were conducted as needed to prepare the QAPP (refer to Worksheet No. 9 for meeting attendees). Problem definition and project quality objectives are outlined in Worksheet No. 10.

Problem definition includes the location of buried waste materials present at the site, the nature of the buried waste materials, if associated contaminated soils are present. The objectives will be met through the excavation of eight test pits and the collection of subsurface soil samples.

### 1.4.2 Site History and Background

A complete site background and history are location in Section 2.0 of the WP.

## 1.5 PROJECT QUALITY OBJECTIVES AND MEASUREMENT PERFORMANCE CRITERIA

This section summarizes the Project Quality Objectives (PQOs) for the fieldwork activities. The PQOs were developed in accordance with the USEPA Guidance for the Data Quality Objective Process, commonly known as QA/G-4 (USEPA, 2006). The following discussion provides information on the project planning conducted to develop the PQOs, the project definition, the project quality objectives, and measurement performance criteria identified based on the PQOs.

### 1.5.1 Development of Project Quality Objectives Using the Systematic Planning Process

The PQOs outlined in Worksheet No. 11 address the type, quantity, and quality of data to be determined using the systematic planning process, which is an iterative approach used by the project planners to ensure overall project goals are achieved. Through the use of the worksheets included in this QAPP, the planning process is documented throughout the development of the planning documents to ensure goals and objectives are satisfied.

### 1.5.2 Measurement Performance Criteria

Measurement performance criteria (MPCs) are the PARCCS parameters (i.e., precision, accuracy, representativeness, comparability, completeness, sensitivity), which are qualitative and quantitative statements regarding the quality characteristics of the data used to support project objectives and ultimately, environmental decisions. Each of these parameters is described below and is displayed for each matrix, analytical group, and concentration level in Worksheet No. 12.

#### 1.5.2.1 Precision

Precision is a measure of the degree to which two or more measurements are in agreement and describes the reproducibility of measurements of the same parameter for samples analyzed under similar conditions. A fundamental tenet of using precision measurements for quality control (QC) is that precision will be bounded by known limits. Results outside these predetermined limits trigger corrective actions.

By definition, chemical solutions are uniform in composition. Therefore, ignoring any imprecision caused by the sample matrix, the variability of analytical results for water samples should be relatively low unless suspended material or sample handling and storage introduce additional imprecision.

Field precision is assessed by collecting and measuring field duplicates at a rate of 1 duplicate per 10 environmental samples. Acceptance limits for field duplicate precision are provided in Worksheet No. 12. This precision estimate encompasses the combined uncertainty associated with sample collection, homogenization, splitting, handling, laboratory, and field storage (as applicable), preparation for analysis, and analysis. In contrast, precision estimates obtained from analyzing duplicate laboratory samples incorporate only homogenization, subsampling, preparation for analysis, laboratory storage (if applicable), and analysis uncertainties. Consequently, the field precision estimates [i.e., relative percent difference (RPD) values] should equal or exceed the laboratory precision estimates, on average, for each analyte. If field duplicate precision is significantly different from laboratory duplicate precision, the underlying cause will be investigated to determine whether the observed difference could be artifacts of sampling and analysis.

Laboratory precision QC samples [i.e., laboratory duplicates for inorganic chemicals and matrix spike duplicates (MSDs) for organic chemicals] will be analyzed with a minimum frequency of 5 percent (i.e., 1 QC sample per 20 environmental samples). Laboratory precision is measured by comparing RPD values to precision control limits specified in Worksheet No. 12.

Field duplicate sample results, laboratory duplicate results, sampling procedures, sample transport problems (if any), sample matrix problems (if any), and sample heterogeneity will be considered, as appropriate, to evaluate the overall data precision. Field duplicate precision, expressed as RPD for groundwater sample, must be less than 30 percent. For example, field duplicate precision will be compared to laboratory precision. The RPD between a sample or matrix spike (MS) (Sample 1) and its duplicate or MSD (Sample 2) is calculated for chemical analyses using the following formula:

$$\text{RPD} = \frac{|\text{Amount in Sample 1} - \text{Amount in Sample 2}|}{0.5\,(\text{Amount in Sample 1} + \text{Amount in Sample 2})} \text{ X } 100\,\%$$

### 1.5.2.2 Accuracy

Accuracy is the degree of agreement between an observed value and an accepted reference value. This parameter is assessed by measuring spiked samples [e.g., surrogate spikes or (MSs)] or well-characterized samples of certified analyte concentrations [e.g., laboratory control samples (LCSs)] and by measuring laboratory and field blanks. Accuracy measurements are designed to detect biases resulting from sample handling and analysis. The data validation process during which these evaluations are made is described in Section 4.2. Calculation of accuracy is described below.

Accuracy requirements for field measurements are typically ensured through control over the sample collection and handling and through routine instrument calibration. Accuracy is also typically monitored through the use of blanks to detect cross-contamination and by monitoring adherence to procedures that prevent sample contamination or degradation. Equipment rinsate blanks are not expected to be collected because the sampling equipment is dedicated and disposable. However, if equipment rinsate blanks will be collected at a rate of 1 per 20 per matrix if non-dedicated sampling equipment is required. Ambient condition blanks will not be collected unless site conditions during sampling (e.g., generation of fugitive dust) indicate a need to assess infiltration of airborne contaminants into sampling containers. Source water blanks (field blanks) will be collected to monitor the purity of water used to decontaminate sampling equipment. Trip blanks, used to gauge whether cross-contamination is occurring during sample storage and transport, will be placed into each cooler containing samples to be analyzed for VOCs. Accuracy shall also be assured qualitatively through adherence to all sample handling, preservation, and holding time requirements.

Accuracy in the laboratory is measured through the comparison of a spiked sample or LCS result to a known or calculated value and is expressed as a percent recovery (%R). It is also assessed by monitoring the analytical recovery of select surrogate compounds added to samples that are analyzed by organic chromatographic methods. MS and surrogate compound analyses measure the combined accuracy effects of the sample matrix, sample preparation, and sample measurement. LCSs are used to assess the accuracy of laboratory operations with minimal sample matrix effects. Post-digestion spikes (PDSs) are used to assess the accuracy of the analytical measurement on the sample extract or digestate. Each spike sample shall be spiked with representative project target analytes for the analysis being performed to ensure that accuracy measures are obtained for each target analyte. Spiking concentrations shall equal or approximate the default concentrations detailed in the applicable sample preparation or analysis SOPs. LCS and MS analyses are performed at a frequency no less than 1 per 20 associated samples of like matrix.

The percent recovery (%R) for a spiked sample is calculated by using the following formula:

$$\%R = \frac{\text{Amount in Spiked Sample} - \text{Amount in Sample}}{\text{Known Amount Added}} \text{ X } 100\,\%$$

LCSs and surrogate spikes are also analyzed to assess accuracy. The %R calculation for LCSs and surrogate spikes is as follows:

$$\%R = \frac{\text{Experimental Concentration}}{\text{Certified or Known Concentration}} \text{ X } 100\,\%$$

Control charts are plotted by the laboratory for each target analyte and are kept on a matrix- and analyte-specific basis. These control charts are used to calculate the upper and lower QC limits for evaluating precision and bias.

During data validation, any data not meeting accuracy specifications are identified to the data user through the use of data qualifiers. The field and laboratory blanks provide indications of the potential for having contaminated samples before or during analysis, respectively. Each type of blank will be evaluated for its impact on the sampling or the analytical processes, as appropriate. Laboratory control standards and check standards indicate whether analyte quantitation is accurate and whether the analytical system was capable of generating results within the project accuracy specifications. MS recoveries indicate and will be evaluated to assess the impact of specific sample matrices on the accuracy of project data.

### 1.5.2.3 Sample Representativeness

Sampling and analysis methods and procedures were selected during project planning to provide data representing environmental media at locations selected without bias. Adherence to the standardized sampling, handling, preparation, analysis, and reporting procedures ensures that the final data accurately represent the desired populations. To evaluate the representativeness, the actual samples collected will be compared to the samples that were intended to be collected. Furthermore, the data verifications and validations will be reviewed to ensure that data have met project specifications for precision and accuracy. The degree to which project specifications have been met will provide a qualitative assessment of the representativeness.

### 1.5.2.4 Comparability

Comparability is defined as the confidence with which one data set can be compared to another (e.g., between sampling points and between sampling events). Comparability is achieved by using standardized sampling and analysis methods and data reporting formats (including use of consistent units of measure), and by ensuring that quantitation limits (QLs) and method detection limits (MDLs) are sufficiently low to satisfy project action limits for the duration of the project. The QLs and MDLs anticipated for this project are presented in Worksheet No. 15. Additionally, consideration was given to seasonal conditions and other environmental variations that could exist to influence analytical results, but no such influences appear to exist for this investigation that would indicate a need to collect samples at times other than those planned for this investigation.

### 1.5.2.5 Completeness

Completeness will be computed in accordance with the following equation:

$$\%\,\text{Completeness} = \frac{\text{Number of Valid Measurements}}{\text{Number of Measurements Planned}} \text{ X } 100\,\%$$

Completeness is a measure of the amount of valid data obtained from the measurement program, compared to the total amount collected. Valid data are defined as data that have not been rejected or considered unusable during validation or data review. Percent completeness is expressed as the ratio of the number of validated data points to the number of planned data points. For relatively clean, homogeneous matrices, 100 percent completeness is expected. However, as matrix complexity and heterogeneity increase, completeness may decrease. Where analysis is precluded or where PQOs are compromised, the ability to achieve project objectives will be evaluated. Whether any particular sample is critical (i.e., absolutely necessary for the attainment of project objectives) to the investigation will be evaluated in terms of the sample location, the parameter in question, the intended data use, and the effects of an incomplete data set on the attainment of project objectives.

Critical data points may not be identified until all the analytical results are evaluated. If in the evaluation of results it becomes apparent that the data for a specific medium are of insufficient quality (i.e., less than 95 percent completeness), either with respect to the number of samples or an individual analysis, resampling to replace the deficient data points may be necessary. The U.S. Navy and TtNUS will determine whether resampling is necessary.

#### 1.5.2.6 Sensitivity and Quantitation Limits

Sensitivity is the ability of the method or instrument to detect the target analytes at the level of interest. The QL is the minimum concentration of an analyte that can be routinely identified and quantified above the MDL by a laboratory. The MDL is the minimum concentration of an analyte that can be reliably distinguished from background noise for a specific analytical method.

Analyte MDLs and QLs have been compared to project action limits [i.e., USEPA Region 3 Risk-based Concentrations (RBCs)] to determine if the chosen analytical method is sensitive enough to meet the PQOs. Table/Worksheet No. 15 displays the comparison of STL Laboratories analytical MDLs and QLs to project action limits by method and matrix. The methods of analysis chosen can meet most of the project action limits for volatile organic compounds (VOCs), semi-volatile organic compounds (SVOCs), pesticides, polychlorinated biphenyls (PCBs), dioxins/furans, metals, and cyanide as shown in Table/Worksheet No. 15.

## 1.6 SECONDARY DATA EVALUATION

Secondary data are data that were collected previously by external and/or independent parties that are subsequently transmitted to the current data user. Worksheet No. 13 lists data collected during previous rounds of investigation as relevant to this performance monitoring sampling event.

Secondary data from the RI reports (HNUS, 1993 and Brown and Root, 1997) will be combined with current investigation data (fully validated) and used for determination of the risks associated with the soil contamination. Additionally, secondary data in the form of historical maps and photographs from the previous events at NAS JRB Willow Grove will be used.

## 1.7 PROJECT OVERVIEW AND SCHEDULE

The section summarizes project activities and provides the schedule for each task.

### 1.7.1 Project Overview

Test pits will be excavated and soil samples will be collected in order to complete this supplemental investigation. Tasks include field implementation of sampling programs outlined in this QAPP and completion of an investigation report. A summary of project tasks are shown in Worksheet No. 14. Worksheet/Table No. 15 displays QLs and MDLs in comparison to project action limits.

### 1.7.2 Project Schedule

The project schedule is displayed in Worksheet No. 16. It is anticipated that fieldwork will begin on April 30, 2007 and will be completed by May 11, 2007.

# 2.0 MEASUREMENT/DATA ACQUISITION

## 2.1 SAMPLING TASKS

This section of the QAPP addresses the components of the sampling system, including sampling process design and rationale, procedures, and requirements.

### 2.1.1 Sampling Process Design and Rationale

The design and rationale of the proposed supplemental investigation is presented in Worksheet No. 17. Figure D-1 presents the proposed test pit locations. Tasks include excavation of test pits and collection of soil samples to supplement data gaps presented in the RI report.

### 2.1.2 Sampling Procedures and Requirements

#### 2.1.2.1 Sampling Collection Procedures

A summary of test pit location IDs, sample IDs, depths, SOPs, and summary of rationale for sampling tasks is provided in Worksheet No. 18. For the sampling event, sample identification will be sequential for all media with a designator for Site 3 followed by the media and unique sample location identifier. All TtNUS SOPs relevant to the investigation are listed on Worksheet No. 21 and the SOPs are included in Appendix A.

#### 2.1.2.2 Sample Containers, Volume, and Preservation

Sample specific information on containers, volume, and preservation requirements is provided on Worksheet No. 19.

#### 2.1.2.3 Field Quality Control Samples

The collection of QC samples will include blind duplicates, matrix spike, trip blank, field blank, and equipment blank samples. A summary of the frequency of QC sampling is included on Worksheet No. 20.

#### 2.1.2.4 Equipment/Sample Containers Cleaning and Decontamination Procedures

Sample containers will be shipped certified from the analytical laboratories. Sampling equipment decontamination procedures are not expected to be necessary since dedicated and disposable hand trowels will be used to collect the soil samples. However, in the event that non-disposable trowels are used, the sample equipment decontamination procedures are presented in SOP SA-7.1 in Appendix A.

#### 2.1.2.5 Field Equipment Calibration, Maintenance, Testing, and Inspection Procedures

The procedures associated with field equipment usage, maintenance, testing, and inspection are provided in Worksheet No. 22.

#### 2.1.2.6 Field Documentation Procedures

Field documentation will be performed in accordance with SOP SA-6.3 presented in Appendix A.

A summary of all field activities will be properly recorded in a bound logbook with consecutively number pages that cannot be removed. Logbooks will be assigned to field personnel and will be stored in a secured area when not in use.

At a minimum, the following information will be recorded in the site logbook:

- Name of the person to whom the logbook is assigned.
- Project name.
- Project start date.
- Names and responsibilities of on-site project personnel including subcontractor personnel.
- Arrival/departure of site visitors.
- Arrival/departure of equipment.
- Sampling activities and sample log sheet references.
- Description of subcontractor activities.
- Sample pick-up information including COC numbers, air bill numbers, carrier, time, and date.
- Description of borehole or monitoring well installation activities and operations.
- Health and safety issues.
- Description of photographs including date, time, photographer, roll and picture number, location, and compass direction of photograph.

All entries will be written in ink and no erasures will be made. If an incorrect entry is made, striking a single line through the incorrect information will make the correction; the person making the correction will initial and date the change.

## 2.2 ANALYTICAL TASKS

This section provides information with regard to the analytical SOPs, calibration procedures, instrument/equipment maintenance, testing, and inspection procedures for the selected laboratory(s). STL Laboratories will be utilized for the chemical analysis of the soil samples. STL Laboratories is NFESC approved and NELAP accredited and certificates of accreditation are available upon request from STL Laboratories.

### 2.2.1 Analytical SOPs

All relevant analytical SOPs are summarized in Worksheet No. 23 in Appendix C.

### 2.2.2 Analytical Instrument Calibration Procedures

All instrument calibration, frequency of calibration, acceptance criteria, corrective action, and person responsible for corrective action are displayed in Worksheet No. 24.

### 2.2.3 Analytical Instrument and Equipment Maintenance, Testing, and Inspection Procedures

All instrument and equipment maintenance, testing, and inspection procedures are displayed in Worksheet No. 25.

### 2.2.4 Analytical Supply Inspection and Acceptance Procedures

The laboratory must be able to demonstrate that all supplies required for analytical work will be available when needed and will be free of target compounds and any analytical interference.

## 2.3 SAMPLE COLLECTION DOCUMENTATION, HANDLING, TRACKING, AND CUSTODY PROCEDURES

The following sections outline the procedures that will be used to document project activities and sample collection, handling, tracking, and custody procedures during performance monitoring tasks. Detailed and accurate documentation is necessary in order to ensure data integrity, authenticity, and defensibility.

### 2.3.1 Sample Collection Documentation

Samples will be collected following procedures outlined in Appendix A. The equipment used to collect the sample will be noted in the logbook, along with date and time of sampling, sampler's name, sample description, depth at which the sample was collected, and the volume and number of containers collected. QC sample information will be appropriately recorded. Measurements made will be recorded. All instruments used to make measurements will be identified, along with the date of calibration.

Standard log sheets will be used to record data and will include:

- Test Pit log;
- Soil sample log; and
- COC record.

Log sheets will include entries in every blank, with appropriate use of the abbreviations NA (not applicable) and NR (not recorded). All "NR" entries should be accompanied by and explanation. All entries will be recorded in waterproof ink and signed and dated by the person making the entry. No erasures will be made. If an incorrect entry is made, the information will be crossed out with a single strike mark, the correct entry recorded, and the change initialed and dated by the person making the correction.

### 2.3.2 Sample Handling and Tracking System

The following subsections outline the procedures that will be used by field and laboratory personnel to document sample collection activities during the performance monitoring sampling event. Detailed and accurate documentation is necessary in order to ensure data integrity.

#### 2.3.2.1 Sample Handling

Sample handling is described in Worksheet No. 26.

#### 2.3.2.2 Sample delivery

The shipment of samples to the laboratory will be made by a shipping courier service (e.g. Federal Express), unless the laboratory is close enough to the site to provide a pickup service. After samples have been collected, they will be sent to the laboratory within 24 to 72 hours depending on the analyte holding time. Under no circumstances will sample holding times be exceeded.

### 2.3.3 Sample Custody

To ensure the integrity of a sample from collection through analysis, it is necessary to have an accurate, written record that traces the possession and handling of the sample. This documentation is referred to as the chain-of-custody (COC) form. The chain of custody begins at the time of sample collection. The laboratory will provide forms that will be used for chain of custody documentation.

A sample is under custody if:

- The sample is in the physical possession of an authorized person.
- The sample is in view of an authorized person after being in his/her possession.
- The sample is placed in a secure area by an authorized person after being in his/her possession.
- The sample is in a secure area, restricted to authorized personnel only.

Custody documentation is designed to provide documentation of preparation, handling, storage, and shipping of all samples collected. A multi-part form is used with each page of the form signed and dated by the recipient of a sample or portion of sample. The person releasing the sample and the person receiving the sample will each retain a copy of the form each time a sample transfer occurs.

Integrity of the samples collected during the site investigation will be the responsibility of identified persons from the time the samples are collected until the samples, or their derived data, are incorporated into the analytical report. Sample custody is described in Worksheet No. 27.

The Field Operations Leader (FOL) is responsible for the care and custody of the samples collected until they are delivered to the laboratory or are entrusted to a shipping courier. When transferring samples, the individuals relinquishing and receiving the samples will each sign the chain-of-custody form and the date and time will be recorded. This documents the sample custody transfer from the sampler to the shipping courier, and finally to the laboratory. Upon arrival at the laboratory, internal sample custody procedures will be followed as defined in the laboratory SOPs included in Appendix C.

## 2.4 QUALITY CONTROL SAMPLES

This section describes the QC samples that will be collected as part of this performance monitoring sampling event.

### 2.4.1 Sampling Quality Control Samples

QC samples will be collected or generated during environmental sampling activities and will include field duplicates for groundwater, soil and sediment, where appropriate. A summary of QA/QC samples requirements are provided in Worksheet No. 20. The four types of field QC samples are defined as follows:

Field Duplicates - Field duplicates are used to assess the overall precision of the sampling and analysis program. Field duplicates will be collected at a frequency of 10 percent per sampling matrix. Duplicates are submitted for laboratory analyses for the same analytical parameters as the associated environmental samples.

Source Water Blank (Field) - Source water blanks are collected to assess the presence of contamination in the water used to decontaminate the sampling equipment. One source water blank is to be collected for each type of decontamination water (i.e., deionized water, tap water, etc.) used during each sampling phase. Source water blanks are not expected to be collected for this project because dedicated and disposable trowels will be used.

Trip Blank - Trip blanks are vials of water supplied by the laboratory that are sent to the field and returned to the laboratory unopened. They are designed to detect VOC cross-contamination from one sample container to another via vapor transfer during storage and shipment. One trip blank will be included in every cooler requiring VOC sample analyses.

Equipment Rinsate Blanks - Equipment rinsate blanks are obtained under representative field conditions by running analyte-free water through or over decontaminated sample collection equipment (i.e., bailer, direct push cutting shoe, etc.). Equipment rinsate blanks will be used to assess the effectiveness of decontamination procedures. Equipment rinsate blanks will be collected for each type of non-dedicated sampling equipment used and will be submitted at a frequency of one per day or one per 20 units of a medium sampled, whichever is less. Equipment rinsate blanks will be analyzed for the same analytical parameters as the associated environmental samples and will be collected in the appropriate sample containers. Equipment rinsate blanks are not expected to be collected for this project because dedicated and disposable trowels will be used.

Temperature Blank - Temperature blanks are vials of water inserted into each sample cooler prior to shipment from the field. The temperature of the temperature blank is measured upon receipt at the laboratory to assess whether samples were properly cooled during transit.

### 2.4.2 Analytical Quality Control Samples

Analytical QC samples to be used during the performance monitoring sampling event are provided in Worksheet No. 28.

## 2.5 DATA MANAGEMENT TASKS

This section describes how project information will be managed, organized, and maintained for efficient use by project personnel. The information management process is outlined from data generation to ultimate storage.

### 2.5.1 Project Documentation and Records

A summary of project documentation and records to be generated and stored in the project files is provided in Worksheet No. 29.

### 2.5.2 Data Package Deliverables

Certain field measurements (i.e., photo-ionization detection (PID), etc.) are made primarily for health and safety monitoring. For this investigation, PID readings will also be used as a soil field screening technique. These data will be recorded on log sheets and or in the project logbook.

For the performance monitoring and site-wide monitoring sampling events, the fixed-base laboratory will provide Contract Laboratory Program (CLP) equivalent data packages for volatiles, semi-volatiles, pesticides, PCBs, and inorganic analysis. Additionally electronic deliverables, formatted according to the requirements stated in the laboratory subcontracts, will be provided by the laboratories for all analytical data. Worksheet No. 30 summarizes the analytical requirements.

### 2.5.3 Data Reporting Formats

Field data will be recorded on log sheets or in the project logbook. STL Laboratories will provide CLP equivalent data reporting forms 1 through 15 for the required metals and organic analyses presented in the previous paragraph.

### 2.5.4 Data Handling and Management

The data-handling procedures to be followed by STL Laboratories will meet the requirements in the laboratory subcontract. All analytical and field data will be maintained in the project files. The project files will contain hard copies of the COC forms, sample log forms, sample location maps, and documentation of quality assurance of data manipulation.

### 2.5.5 Data Tracking and Control

A "cradle-to-grave" sample tracking system will be used from the beginning to the end of the sampling event. Before field mobilization, the FOL will coordinate/initiate the sample tracking process. Sample jar labels will be hand-written in the field.

The labels will be reviewed for adherence to work plan requirements as well as for accuracy. The Project Manager (PM) will coordinate with the analytical laboratory to ensure that they are aware of the number and type of samples and analyses.

When field sampling is underway, the FOL forwards the COC forms to the PM or designee and the laboratory for each day that samples are collected. The PM or designee will confirm that the COC forms provide the information required by the work plan.

This will allow for early detection of errors made in the field so that adjustments can be made while the field team is mobilized. After successful completion of all requested analyses, the laboratory will submit an electronic deliverable for every sample delivery group (SDG). When all electronic deliverables have been received from the laboratory, the PM or designee will ensure that the laboratory performed all the requested analyses. Ideally, discrepancies can be noted early enough so that all samples can be analyzed within the prescribed holding times.

#### 2.5.5.1 Sample Information

Data from field measurements will be recorded using the appropriate log sheets.

Reduction of field data entails the summarization and presentation of these data in tabular form. The reduction of laboratory data entails the manipulation of raw data instrument output into reportable results. Field data (e.g., photo-ionization detection) will be verified on a daily basis by the FOL. Laboratory data will be verified by the group supervisor and then by the laboratory's QC/Documentation Department.

For field data, the FOL will coordinate with the geographical information system (GIS) lead to ensure that all survey technical specifications are consistent with the underlying coordinate system in the GIS.

Electronic data arriving from the laboratory will pass through to the data validation manager (DVM) for database compilation and validation. The DVM will compile all the formatted laboratory electronic deliverables into a working project database. Data that are to be validated will be printed as data packages, which include the samples as part of each SDG and the appropriate analytical fraction. The data packages will be distributed to the appropriate data validators. The data validators will enter all data qualifiers and qualifier codes into the database and print out a hard copy and return it to the DVM. The DVM will check the data qualifiers and qualifier codes in the project database and print the final validated data for incorporation into the data validation letter. When all samples and analyses have been accounted for and validated, the PM will ensure that the analytical data are incorporated into the project database.

#### 2.5.5.2 Project Data Compilation

The analytical laboratory will generate a pdf file of the analytical data packages, as well as electronic database deliverables. The electronic database will be checked against the pdf file provided by the laboratory and updated as required, based on data qualifier flags applied during the data validation process. The data generated during the implementation of the QAPP will be incorporated into the NAS JRB Willow Grove database and GIS. All data, such as units of measure and chemical nomenclature, will be manipulated to maintain consistency with the project database.

#### 2.5.5.3 Geographical Information System

Data management systems consist of a relational database and GIS that are being used to manage environmental information pertaining to NAS JRB Willow Grove. The relational database stores chemical, geological, hydrogeological, and other environmental data collected during environmental investigations. The GIS is built from the relational database and contains subsets of the larger data pool. Using the GIS, environmental data can be posted on base mapping to provide a graphical representation of the information.

Upon compilation of sample, chemical, biological, and positional data, the data will be compiled and incorporated into the NAS JRB Willow Grove GIS. The GIS system can be used to generate various maps for NAS JRB Willow Grove data including site location maps, sample location maps, and contaminant tag maps, as needed. The GIS software that is used will be documented in performance monitoring reports.

## 2.6 EQUIPMENT DECONTAMINATION

Decontamination of sampling equipment will not be necessary for this project because dedicated and disposable hand trowels will be used. However, if decontamination is necessary, these requirements will apply. Decontamination of sampling equipment (e.g., non-disposable hand trowels, hand augers) will be conducted prior to and between sampling at each location. At each site, an abbreviated decontamination procedure consisting of a soapy water (laboratory-grade detergent) rinse followed by a deionized water rinse will be performed. However, if free product is encountered, a more elaborate decontamination of equipment will be conducted in accordance with TtNUS SOP SA-7.1.

## 2.7 WASTE HANDLING

Solid or semi-solid investigation-derived waste (IDW) (i.e., soil, sediment, etc.) will not be generated during this field activity during the test pit excavation. Soils will be replaced into the test pit where the soils where excavated. The only solid IDW anticipated is personal protective equipment (PPE), which will be bagged and deposited in an appropriate facility waste container. If waste materials are encountered, NAVY personnel will be contacted and the waster material/soil will be staged in the appropriate manner until disposal.

Equipment decontamination fluids will be generated during the test pit activities. The backhoe will be cleaned after each test pit. The decontamination water will be discharged to the ground.

# 3.0 ASSESSMENT AND OVERSIGHT

## 3.1 ASSESSMENT AND RESPONSE ACTIONS

Assessment activities ensure that the data quality is adequate for the data's intended use and that appropriate corrective actions are implemented to address nonconformance's and deviations from the QAPP.

### 3.1.1 Planned Assessments

The planned assessments are system audits and field audits. The assessments planned for this project are identified in Worksheet No. 31.

System audits will be performed as appropriate to ensure that work is being implemented in accordance with the approved project SOPs and in an overall satisfactory manner. These audits will be performed in the following manner:

- The FOL will supervise and check on a daily basis that the field measurements are made accurately, equipment is thoroughly decontaminated, samples are collected and handled properly, and fieldwork is accurately and neatly documented. Documentation includes verifying that the sample names on sample log sheets, field notes, chain-of-custody records, and sample labels are identical matches to sample names in the QAPP. The FOL will update the PM of field activities on a daily basis.

- System audits for the laboratory will be performed regularly and in accordance with NFESC guidance and DOD QSM (January 2006), as provided in the Laboratory Quality Assurance Plan (LQAP).

- The data validator will review the chemical analytical data packages submitted by the laboratory. The data validator will check that the data were obtained through use of the approved methodology, that the appropriate level of QC effort and reporting was conducted, and whether or not the results are in conformance with QC criteria. On the basis of these factors, the data validator will generate a report describing data limitations that will be reviewed internally by the DVM before submittal to the PM.

- The PM will maintain contact with the FOL and DVM to ensure that management of the acquired data proceeds in an organized and expeditious manner.

Additionally, an independent performance audit of field activities may be conducted at the discretion of and under the direction of the QA officer. If a formal field audit is conducted, the QA officer will check that sample collection, handling, and shipping protocols, as well as equipment decontamination and field documentation procedures, are being performed in accordance with the approved project planning documents and SOPs.

Performance audits of laboratories are coordinated through NFESC and are conducted every 18 months by NFESC's independent quality assurance contractor.

### 3.1.2 Assessment Findings and Corrective Action Responses

Assessment findings that require corrective action initiate a sequence of events that include documentation of deficiencies, notification of findings, request for corrective action, implementation of corrective action, and follow-up assessment of the corrective action effectiveness. Worksheet No. 32 summarizes the procedure for handling any QAPP deviations and project deficiencies that are identified through the planned project assessments.

Potential problems may involve nonconformance with the SOPs and/or analytical procedures established for the project or other unforeseen difficulties. Any person identifying a condition adverse to project quality will notify the PM. The PM, with the assistance of the QA manager, will be responsible for developing and initiating appropriate corrective action through the FOL and verifying that the corrective action has been effective. Corrective actions may include the following: resampling and/or reanalyzing a sample or amending or adjusting project procedures. If warranted by the severity of the problem (for example, if a major change in the approved plan is required), the U.S. Navy will be notified in writing and the U.S. Navy's approval will be obtained before any change is implemented. Minor changes will be documented for the main file by the TtNUS PM. Additional work that depends on a nonconforming activity will not be performed until the problem has been corrected. The overall corrective action responsibility for system audits will reside with the PM. The overall corrective action responsibility for field audits will reside with the QA manager.

For quality assurance issues involving the analytical laboratory used for the project, the laboratory also maintains an internal closed-loop corrective action system that operates under the direction of the laboratory QA coordinator.

## 3.2 QA MANAGEMENT REPORTS

This section presents the activities that will be performed to keep management updated on the project status. Open communication pathways will benefit the project by allowing appropriate personnel to be consistently aware of salient project activities and to provide opportunities for input in a timely manner. Input from these parties will be used to make necessary corrective actions so project quality objectives are met.

The information to be included in each of the QA Management Reports listed in Worksheet No. 33 is summarized in the following sections.

**Field Status Reports**

The FOL will give verbal or electronic status reports to the PM on a daily basis or more frequently if needed. The status reports will include the field activities completed for the day, the personnel who completed each activity, the future activities planned, and any issues or problems identified.

**Data Validation Reports**

Data validation reports will be prepared and formatted as described in Section 4.2. The data validation reports will be included as an appendix to the test pit investigation report.

## 3.3 OUTLINE OF PROJECT REPORTS

A test pit investigation report will be generated that summarizes the results of this test pit excavation and soil sampling event with previous events at Site 3 and provides conclusions and recommendations regarding the location and nature and extent of contamination at Site 3.

# 4.0 DATA REVIEW

## 4.1 OVERVIEW

Data verification is a process of evaluating the completeness, correctness, and contractual compliance of a data set against the method standard, SOP, or contract requirements documented in this QAPP. Data validation is an analyte- and sample-specific process that extends the qualification of data beyond data verification to determine the quality of a specific data set.

The internal data verification requirements for this project include the maintenance and periodic review of field documentation (i.e., site logbooks, instrument calibration logs, chain-of-custody forms, field summary reports, and field modification records) and laboratory analytical data packages.

Data validation is a systematic review of the analytical data package with respect to sample receipt and handling, compliance with required analytical methods, data reporting and deliverables, and document control. A qualified chemist will review the analytical data packages using USEPA procedures. One hundred percent of the environmental samples will be validated.

## 4.2 DATA REVIEW STEPS

After receipt of analytical laboratory results, TtNUS will perform data validation according to the requirements outlined in the National Functional Guidelines for Organic and Inorganic Data Review (USEPA, 1999 and 2004) the Region 3 Modifications to the National Functional Guidelines for Organic and Inorganic Review (USEPA, 1993 and 1994), and method-specific requirements to ensure that the analytical results meet the project quality objectives. Dioxin/furan data will be validated according to the requirements outlined in the National Functional Guidelines for Chlorinated Dioxin/Furan Data Review (USEPA, 2005) and the Region 3 Dioxin/Furan Data Validation Guidance (USEPA, 1999).

After the data are validated, a list of nonconformities will be generated. Nonconformities require data qualifiers, which are used to alert the data user to inaccurate or imprecise data. For situations in which several quality control criteria are out of specification with regard to the limits specified in the DOD QSM (January, 2006), the data validator may make professional judgments and/or comments on the validity of the overall data package. In situations where the validity of an entire data package is in question, it may be necessary for the sample(s) to be reanalyzed. The reviewer will then prepare a technical memorandum presenting changes in the data, if necessary, and the rationale for making such changes.

The net result is a data package that has been carefully reviewed for its adherence to prescribed requirements and is suitable for its intended use. Data validation therefore plays a major role in determining the confidence with which key technical evaluations may be made.

Data validation reports for all parameters will be generated according to the procedures described in SOPs DV-02 and DV-04. The final data validation report will include a technical memorandum, qualified analytical results, results reported by the laboratory, and documentation to support data qualification. All data will be flagged by an appropriate qualifying symbol.

The data and field records will also be reviewed by project personnel to ensure that the samples represent the intended sampling conditions and populations. Data qualified during validation will be reviewed to assess the impact of the qualifiers on the attainment of project objectives.

### 4.2.1 Step I: Verification

Verification includes field data and laboratory data verification. Verification inputs as per Worksheet No. 34 will be checked by the DVM.

### 4.2.2 Step II: Validation

Validation of field measurements and laboratory analytical data is discussed in this section. Validation of field data will be limited to real-time checks in the field as data are generated, whereas laboratory analytical data will be validated in accordance with USEPA guidance. Step IIa validation procedures (i.e., compliance with methods, procedures and contracts) are discussed in Section 4.2.2.1. Step IIb validation procedures (i.e., comparison of analytical results to the RBCs documented in this QAPP) are discussed in Section 4.2.2.2.

#### 4.2.2.1 Step IIa: Validation Activities

Step IIa validation activities are documented in Worksheet No. 35. Data validation will be completed to ensure that the data are of evidentiary quality. Particular emphasis will be placed on holding time compliance, laboratory control samples, spike recoveries, and field blank samples, although all required elements of the validation process will be considered.

One hundred percent of the laboratory data from chemical analyses will be validated. Validation of analytical data will be conducted by TtNUS. Final review and approval of validation deliverables will be completed for the DVM. VOCs, SVOCs, pesticides, PCBs, and inorganic results will be validated according to the requirements of USEPA National Functional Guidelines for Organic and Inorganic Data

Review and Region 3 Modifications. Each analysis will be validated in accordance with Worksheet No. 36.

As part of the validation process, the validator will check that the laboratory has provided all the documentation required to support the reported analytical results. If any documentation is missing from the data package, the data validator will contact the laboratory to request a resubmittal. If the laboratory fails to resubmit the requested information, the data validator will note this on the data validation cover letter. The usability of such data will then be determined by the PM and the U.S. Navy.

#### 4.2.2.2 Step IIb: Validation Activities

Worksheet No. 35 summarizes the Step IIb data validation activities.

### 4.2.3 Step III: Data Usability Assessment

Section 1.7.2 contains a PARCCS description and Worksheets No. 12, No. 15, and No. 28 provide project-specific RBCs.

After data validation and an overall review of data quality indicators, the data will be reconciled with MPCs to determine whether sufficient data of acceptable quality are available for decision making. A series of inspections and statistical analyses will be performed to estimate several of the data set characteristics. The statistical evaluations will include simple summary statistics for target analytes, such as the maximum concentration, minimum concentration, number of samples exhibiting no detectable analyte, the number of samples exhibiting detectable analytes, and the proportion of samples with detectable and undetectable analytes. The data will be presented in a tabular format. These inspections and statistical analyses will be designed to:

- Identify deviations, if any, from the field sampling SOPs.
- Identify deviations, if any, from the laboratory analytical methods.
- Identify deviations, if any, from the QAPP.
- Identify deviations, if any, from the data validation process.
- Evaluate effects of the above-listed deviations from planned procedures and processes on the interpretation and utility of the data using statistics, if applicable.

- Identify elevated detection limits and explain their impacts on the attainment of project objectives.
- Identify unusable data (i.e., data qualified as "UR" and "R").
- Evaluate project assumptions.
- Characterize data set distributions (e.g., Shapiro-Wilk W test) if enough data are available.
- Identify unanticipated data set characteristics such as a laboratory variance greater than the sampling variance (i.e., ANOVA, *t*-test) if enough data are available.
- Identify and evaluate potential data outliers (95 percent confidence goodness-of-fit test on probability plot data). The plotted data will be transformed, if necessary, depending on the observed distribution.
- Evaluate adherence to investigation objectives and decision rules using statistics, if applicable.
- Ensure completion of corrective actions.
- Identify the existence of remaining data gaps.

For statistical comparisons and mathematical manipulations, non-detect values will be represented by a concentration equal to one-half the sample-specific reporting limit. Duplicate results (original and duplicate) will not be averaged for the purpose of representing the range of concentrations. However, the average of the original and duplicate will be used to represent the COC concentration detected at that sample location.

Statistical tests for outliers will be conducted using standard techniques appropriate for this task. Potential outliers will be removed if a review of field and laboratory documents indicates that the results are true outliers. If no physical cause for a statistical outlier can be identified, the data point will not be removed from the data set. However, if the data point is found to truly represent a physical quantity that is different from the rest of the data set, it will be removed.

The suitability of any given statistical test will be assessed based on the completeness of the data sets and the conditions observed at the site. For example, when a single data value is available for soils or water samples at a given sampling location, statistical tests cannot be conducted for that individual sampling location. However, pooling of data across sampling locations may be possible and, if logical to do so, may be implemented at the discretion of the PM. Statistical testing will generally be conducted at the five percent significance level. Statistical testing at other significance levels may also be warranted to provide perspective on the results of testing at five percent significance. If other significance levels are used, they will be supported with rationales for their use.

#### 4.2.3.1 Data Limitations and Actions from Usability Assessment

After all data evaluations are completed, any limitations on the use of data will be known and the limitations will be considered during decision making. If necessary, investigation objectives may be revised in anticipation of additional data collection in order to meet project quality objectives for the site.

## 4.3 STREAMLINING DATA REVIEW

Streamlining data review is not an applicable task for this project.

# REFERENCES

Brown and Root, 1997. Draft Phase II Remedial Investigation Report for NAS JRB Willow Grove. Brown and Root Environmental.

HNUS, 1993. Remedial Investigation Report for Site 1, 2, 3, and 5, Naval Air Station Willow Grove, Pennsylvania. Halliburton NUS Environmental Corporation. February.

TtNUS, 2007. Work Plan for Test Pit Investigation, Site 3 – Ninth Street Landfill. Tetra Tech NUS. April.

United States Department of Defense (U.S. DOD), 2006. Department of Defense Quality Systems Manual. January.

U.S. DOD, U.S. Department of Energy, USEPA, 2006. Interagency Data Quality Task Force Uniform Federal Policy Quality Assurance Project Plan Manual.

United States Environmental Protection Agency (USEPA), 1999. Region III Dioxin/Furan Data Evaluation Guidance. March.

USEPA, 1999. National Functional Guidelines for Organic Data Review. October.

USEPA, 2004. National Functional Guidelines for Inorganic Data Review. October.

USEPA, 2005. National Functional Guidelines for Chlorinated Dibenzo-p-Dioxins (CDDs) and Chlorinated Dibenzofurans (CDFs) Data Review. September.

USEPA, 2006. Guidance on Systematic Planning using the Data Quality Objectives Process. EPA QA/G-4, EPA/240/B-06/001. USEPA Office of Environmental Information, Washington DC. February.

USEPA, 1986. Test Methods for Evaluating Solid Waste; Physical/Chemical Methods (SW-846), 3rd Edition (including Update III). Office of Solid Waste and Emergency Response, Washington, DC.

# APPENDIX A

## TtNUS STANDARD OPERATING PROCEDURES

- CT-04 Sample Nomenclature
- DV-02 Data Validation – Non-CLP Organics in Solid Matrices
- DV-04 Data Validation – Non-CLP Inorganics in Solid Matrices
- HS-1.0 Utility Locating and Excavation Clearance
- ME-12 Photovac 2020
- SA-1.3 Soil Sampling
- SA-6.3 Field Documentation
- SA-6.1 Non-Radiological Sample Handling
- SA-7.1 Decontamination of Field Equipment and Waste Handling

| TETRA TECH NUS, INC. | STANDARD OPERATING PROCEDURES | Number CT-04 | Page 1 of 6 |
|---|---|---|---|
| | | Effective Date 09/03 | Revision 1 |
| | | Applicability Tetra Tech NUS, Inc. | |
| | | Prepared Risk Assessment Department | |
| Subject SAMPLE NOMENCLATURE | | Approved D. Senovich | |

## TABLE OF CONTENTS

## 1.0 PURPOSE

The purpose of this document is to specify a consistent sample nomenclature system that will facilitate subsequent data management in a cost-effective manner. The sample nomenclature system has been devised such that the following objectives can be attained:

- Sorting of data by matrix.
- Sorting of data by depth.
- Maintenance of consistency (field, laboratory, and data base sample numbers).
- Accommodation of all project-specific requirements.
- Accommodation of laboratory sample number length constraints (maximum of 20 characters).

## 2.0 SCOPE

The methods described in this procedure shall be used consistently for all projects requiring electronic data.

## 3.0 GLOSSARY

None.

## 4.0 RESPONSIBILITIES

**Program Manager** - It shall be the responsibility of the Program Manager (or designee) to inform contract-specific Project Managers of the existence and requirements of this Standard Operating Procedure.

**Project Manager** - It shall be the responsibility of the Project Manager to determine the applicability of this Standard Operating Procedure based on: (1) program-specific requirements, and (2) project size and objectives. It shall be the responsibility of the Project Manager (or designee) to ensure that the sample nomenclature is thoroughly specified in the relevant project planning document (e.g., sampling and analysis plan) and is consistent with this Standard Operating Procedure if relevant. It shall be the responsibility of the project manager to ensure that the Field Operations Leader is familiar with the sample nomenclature system.

**Field Operations Leader** - It shall be the responsibility of the Field Operations Leader to ensure that all field technicians or sampling personnel are thoroughly familiar with this Standard Operating Procedure and the project-specific sample nomenclature system. It shall be the responsibility of the Field Operations Leader to ensure that the sample nomenclature system is used during all project-specific sampling efforts.

## 5.0 PROCEDURES

### 5.1 Introduction

The sample identification (ID) system can consist of as few as 8 but not more than 20 distinct alpha-numeric characters. The sample ID will be provided to the laboratory on the sample labels and chain-of-custody forms. The basic sample ID provided to the lab has three segments and shall be as follows where "A" indicates "alpha," and "N" indicates "numeric":

| A or N<br>3- or 4-Characters | AAA<br>2- or 3-Characters | A or N<br>3- to 6-Characters |
|---|---|---|
| Site Identifier | Sample Type | Sample Location |

Additional segments may be added as needed. For example:

(1) Soil and Sediment Sample ID

| A or N<br>3- or 4-Characters | AAA<br>2- or 3-Characters | A or N<br>3- to 6-Characters | NNNN<br>4-Characters |
| --- | --- | --- | --- |
| Site Identifier | Sample Type | Sample Location | Sample Depth |

(2) Aqueous (groundwater or surface water) Sample ID

| A or N<br>3- or 4-Characters | AAA<br>2- or 3-Characters | A or N<br>3- to 6-Characters | NN<br>2-Characters | -A |
| --- | --- | --- | --- | --- |
| Site Identifier | Sample type | Sample Location | Round Number | Filtered Sample only |

(3) Biota Sample ID

| A or N<br>3- or 4-Characters | AAA<br>2- or 3-Characters | A or N<br>3- to 6-Characters | AA<br>2-Characters | NNN<br>3-Characters |
| --- | --- | --- | --- | --- |
| Site Identifier | Sample Type | Sample Location | Species Identifier | Sample Group Number |

### 5.2 Sample Identification Field Requirements

The various fields in the sample ID will include but are not limited to the following:

- Site Identifier
- Sample Type
- Sample Location
- Sample Depth
- Sampling Round Number
- Filtered
- Species Identifier
- Sample Group Number

The site identifier must be a three- or four-character field (numeric characters, alpha characters, or a mixture of alpha and numeric characters may be used). A site number is necessary since many facilities/sites have multiple individual sites, SWMUs, operable units, etc. Several examples are presented in Section 5.3 of this SOP.

The sample type must be a two- or three-character alpha field. Suggested codes are provided in Section 5.3 of this SOP.

The sample location must be at least a three-character field but may have up to six-characters (alpha, numeric, or a mixture). The six-characters may be useful in identifying a monitoring well to be sampled or describing a grid location.

The sample depth field is used to note the depth below ground surface (bgs) at which a soil or sediment sample is collected. The first two numbers of the four-number code specify the top interval, and the third and fourth specify the bottom interval in feet bgs of the sample. If the sample depth is equal to or greater than 100, then only the top interval would be represented and the sampling depth would be truncated to three-characters. The depths will be noted in whole numbers only; further detail, if needed, will be recorded on the sample log sheet, boring log, logbook, etc.

A two-digit round number will be used to track the number of aqueous samples taken from a particular aqueous sample location. The first sample collected from a location will be assigned the round identifier 01, the second 02, etc. This applies to both existing and proposed monitoring wells and surface water locations.

Aqueous samples that are field filtered (dissolved analysis) will be identified with an "-F" in the last field segment. No entry in this segment signifies an unfiltered (total) sample.

The species identifier must be a two-character alpha field. Several suggested codes are provided in Section 5.3 of this SOP.

The three digit sample group number will be used to track the number of biota sample groups (a particular group size may be determined by sample technique, media type, the number of individual caught, weight issues, time, etc.) by species and location. The first sample group of a particular species collected from a given location will be assigned the sample group number 001 and the second sample group of the same species collected from the same location will be assigned the sample group number 002.

## 5.3 Example Sample Field Designations

Examples of each of the fields are as follows:

Site Identifier - Examples of site numbers/designations are as follows:

A01 - Area of Concern Number 1
125 - Solid Waste Management Unit Number 125
000 - Base or Facility Wide Sample (e.g., upgradient well)
BBG - Base Background

The examples cited are only suggestions. Each Project Manager (or designee) must designate appropriate (and consistent) site designations for their individual project.

Sample Type - Examples of sample types are as follows:

AH - Ash Sample
AS - Air Sample
BM - Building Material Sample
BSB - Biota Sample Full Body
BSF - Biota Sample Fillet
CP - Composite Sample
CS - Chip Sample
DS - Drum Sample
DU - Dust Sample
FP - Free Product
IDW - Investigation Derived Waste Sample
LT - Leachate Sample
MW - Monitoring Well Groundwater Sample
OF - Outfall Sample
RW - Residential Well Sample
SB - Soil Boring Sample
SD - Sediment Sample
SC - Scrape Sample

| | | |
|---|---|---|
| SG | - | Soil Gas Sample |
| SL | - | Sludge Sample |
| SP | - | Seep Sample |
| SS | - | Surface Soil Sample |
| ST | - | Storm Sewer Water Sample |
| SW | - | Surface Water Sample |
| TP | - | Test Pit Sample |
| TW | - | Temporary Well Sample |
| WC | - | Well Construction Material Sample |
| WP | - | Wipe Sample |
| WS | - | Waste/Solid Sample |
| WW | - | Wastewater Sample |

Sample Location - Examples of the location field are as follows:

| | | |
|---|---|---|
| 001 | - | Monitoring Well 1 |
| N32E92 | - | Grid location 32 North and 92 East |
| D096 | - | Investigation derived waste drum number 96 |

Species Identifier - Examples of species identifier are as follows:

| | | |
|---|---|---|
| BC | - | Blue Crab |
| GB | - | Blue Gill |
| CO | - | Corn |
| SB | - | Soybean |

## 5.4 Examples of Sample Nomenclature

The first round monitoring well groundwater sample collected from existing monitoring well 001 at SWMU 16 for a filtered sample would be designated as 016MW00101-F.

The second round monitoring well groundwater sample collected from existing monitoring well C20P2 at Site 23 for an unfiltered sample would be designated as 023MWC20P202.

The second surface water sample collected from point 01 at SWMU 130 for an unfiltered sample would be designated as 130SW00102.

A surface soil sample collected from grid location 32 North and 92 East at Site 32 at the 0- to 2-foot interval would be designated as 032SSN32E920002.

A subsurface soil sample from soil boring 03 at SWMU 32 at an interval of 4 to 5 feet bgs would be designated as 032SB0030405.

A sediment sample collected at SWMU 19 from 0 to 6 inches at location 14 would be designated as 019SD0140001. The sample data sheet would reflect the precise depth at which this sample was collected.

During biota sampling for full body analysis the first time a minnow trap was checked at grid location A25 of SWMU 1415 three small blue gills were captured, collected and designated with the sample ID of 1415BSBA25BG001. The second time blue gill were collected at the same location (grid location A25 at SWMU 1415) the sample ID designation given was 1415BSBA25BG002.

Note: No dash (-) or spacing is used between the segments with the exception of the filtered segment. The "F" used for a filtered aqueous sample is preceded by a dash "-F".

## 5.5 Field Quality Assurance/Quality Control (QA/QC) Sample Nomenclature)

Field QA/QC will be designated using a different coding system. The QC code will consist of a three- to four-segment alpha-numeric code that identifies the sample QC type, the date the sample was collected, and the number of this type of QC sample collected on that date.

| AA | NNNNNN | NN | -F |
|---|---|---|---|
| QC Type | Date | Sequence Number (per day) | Filtered (aqueous only, if needed) |

The QC types are identified as:

TB = Trip Blank
RB = Rinsate Blank (Equipment Blank)
FD = Field Duplicate
AB = Ambient Conditions Blank
WB = Source Water Blank

The sampling time recorded on the Chain-of-Custody Form, labels, and tags for duplicate samples will be 0000 so that the samples are "blind" to the laboratory. Notes detailing the sample number, time, date, and type will be recorded on the routine sample log sheets and will document the location of the duplicate sample (sample log sheets are not provided to the laboratory). Documentation for all other QC types (TB, RB, AB, and WB) will be recorded on the QC Sample Log sheet (see SOP on Field Documentation).

## 5.6 Examples of Field QA/QC Sample Nomenclature

The first duplicate of the day for a filtered ground water sample collected on June 3, 2000 would be designated as FD06030001-F.

The third duplicate of the day taken of a subsurface soil sample collected on November 17, 2003 would be designated as FD11170303.

The first trip blank associated with samples collected on October 12, 2000 would be designated as TB10120001.

The only rinsate blank collected on November 17, 2001 would be designated as RB11170101.

## 6.0 DEVIATIONS

Any deviation from this SOP must be addressed in detail in the site specific planning documents.

## TABLE OF CONTENTS

**SECTION** **PAGE**

## TABLE OF CONTENTS (Continued)

# 1.0 SW-846 ORGANICS BY GC/MS

## 1.1 Volatiles (Method 8260B)

### 1.1.1 Applicability

Method 8260B is used to determine volatile organic compounds in most waste matrices including groundwater, sludges, caustic liquors, acid liquors, waste solvents, oily wastes, mousses, tars, fibrous wastes, polymeric emulsions, filter cakes, spent carbons, spent catalysts, soils, and sediments.

Method 8260B analyte list includes of the volatile CLP 3/90 Target Compound List (TCL) (Section 1.1.1) plus the following compounds*:

Acetonitrile
Acrolein
Acrylonitrile
Allyl chloride
Chloropropene
1,2-Dibromo-3-chloropropane
1,2-Dibromoethane
Dibromomethane
trans-1,4-Dichloro-2-butene
Dichlorodifluoromethane
trans-1,2-Dichloroethene
Ethyl methacrylate
Iodomethane
Methacrylonitrile
Methyl methacrylate
2-Picoline
Pyridine
Trichlorofluoromethane
1,2,3-Trichloropropane
Vinyl acetate

* Appendix IX target compounds

Method 8260B is based upon a purge-and-trap, gas chromatographic/mass spectrometric (GC/MS) procedure. Prior to analysis, samples must be prepared by Method 5030.

### 1.1.2 Interferences

Samples can be contaminated by diffusion of volatile organics (particularly chlorofluorocarbons and methylene chloride) through the sample container septum during shipment and storage. Associated field quality control blanks are analyzed in order to monitor this.

Contamination by carryover can occur whenever high-level and low-level samples are sequentially analyzed. To reduce carryover, the sample syringe or purging device is rinsed out between samples with reagent water. Whenever an unusually concentrated sample is encountered, it should be followed by an analysis of reagent water to check for cross contamination.

If sample or matrix interferences are encountered, a secondary or alternate analytical column may be used to resolve the compounds of interest.

### 1.1.3 General Laboratory Practices

A method blank consisting of organic free water spiked with surrogates and internal standards should be analyzed immediately following each daily calibration and also after the analysis of every high concentration sample.

Matrix Spike/Matrix Spike Duplicate (MS/MSD) analyses should be conducted to determine the effects of sample matrix upon the compounds of interest.

#### 1.1.4 Sample Preparation

Method 5030 is a purge-and-trap procedure performed to prepare and extract volatile compounds from samples and introduce those compounds into the GC/MS.

For highly volatile matrices, direct injection preceded by dilution should be used to prevent gross contamination of the instrumentation. For pastes, dilution of the sample until it becomes free-flowing is used to ensure adequate interfacial area. The success of this method depends on the level of interferences in the sample; results may vary due to the large variability and complicated matrices of solid waste samples.

#### 1.1.5 Data Overview Prior to Validation

Before commencing validation, the reviewer must preview the associated Chain-of-Custody (COC) reports to determine:

- If the appropriate number of samples are present in the data package and if each sample was correctly analyzed for the parameters and methods specified.
- The identity of all associated field quality control blanks and field duplicate pairs.

Because many samples may have required dilutions, re-extractions and/or re-analyses, the validator should preview the data package contents to determine which analyses represent the better quality data.

Unless specifically directed by client protocol, never annotate the laboratory data package. Before beginning evaluation, prepare working copies (i.e., photocopies) of all Form I reports (including those for samples, laboratory method blanks and MS/MSD analyses) and all laboratory quality control summary forms (including all initial and continuing calibration summary statistics).

#### 1.1.6 Technical Evaluation Summary

All data evaluations must be conducted in accordance with applicable USEPA Regional protocols and/or specific client contract requirements. The applicable documents must be referenced during the data evaluation process as this S.O.P. is only intended as a general procedure for the data validation tasks.

General parameters such as Data Completeness, Overall System Performance, Chromatographic Quality, Detection Limits and Compound Identification are evaluated concurrently with the parameters discussed in the following subsections.

1.1.6.1 <u>Holding Times</u>

Holding times are evaluated by reviewing the COC reports, the individual sample Form I reports, and the associated laboratory raw data. Holding times are calculated from date of collection to date of analysis.

The technical maximum holding time allowance for aqueous samples preserved with hydrochloric acid (HCL) is 14 days.

No technical holding times for solid matrices have been promulgated; a 14-day maximum holding time allowance is currently being used.

For unpreserved aqueous samples, generally a 7-day maximum holding time allowance for aromatic compounds, along with a 14-day maximum holding time allowance for chlorinated hydrocarbons is used.

Positive results in affected samples are generally qualified as estimated (J); nondetects (UJ). These results are biased low. Some USEPA Regions apply the bias qualifiers, L and UL, instead. If the holding times are exceeded by a factor of 2 or more, the holding time exceedance is considered to be gross and positive results are generally qualified as estimated (J): nondetects are generally considered to be unreliable and are qualified (R). Results for which the holding time was grossly exceeded are biased low.

1.1.6.2 Calibration

Check that an initial calibration was performed for each instrument used for analysis and that all calibrations were performed at all appropriate concentration levels within 12 hours of the associated instrument tuning.

Review the data package Form Vs (tuning) using the applicable USEPA Regional Functional Guidelines, and qualify the data as appropriate.

Review initial calibration Form VIs and the associated laboratory raw data. Determine which compounds have average Relative Response Factors (RRFs) <0.050 and which compounds have Percent Relative Standard Deviations (%RSDs) >50% and between 30% and 50%. Circle these noncompliances on your working copies of these Forms. Spot-check (i.e., recalculate) a few of the RRFs and %RSDs to verify the laboratory's computation.

Determine which samples are affected by reviewing the continuing calibration Form VIIs. Check the initial calibration date(s) noted in the headings of the Form VIIs to determine which continuing calibrations are associated with which initial calibrations. Next, review the sample listings given on the data package Form Vs. Match the indicated continuing calibration run with the appropriate Form VII by matching the laboratory file ID numbers. Write the affected samples (those listed on the matched Form V) on your working copies of the appropriate Form VI and VII. Spot-check (i.e., recalculate) a few of the RRFs and %Ds to verify the laboratory's computation.

Review the continuing calibration Form VIIs and the associated laboratory raw data. Determine which compounds have RRFs <0.050 and which compounds have Percent Differences (%Ds) >25%; circle the noncompliances on your working copies of these Forms.

Generally, affected positive results for compounds whose RRFs are <0.050 are qualified as estimated (J); nondetects are rejected (R). In accordance with some USEPA Regional protocol, the (L) qualifier may be used instead of (J), when qualifying positive results. Bias for these results is low.

Generally, positive results for compounds for which %RSD exceeds 50% or %D exceeds 25% are qualified as estimated (J); nondetects (UJ). Check the specific applicable data validation protocol for further guidance as there are some protocol which reject nondetects if the %RSD or %D is excessive. Bias for these results cannot be determined.

Generally, positive results for compounds for which %RSD is between 30%-50% are qualified as estimated (J). Qualification of nondetects is protocol-specific. Follow the rules given in the appropriate validation protocol.

1.1.6.3 Blank Contamination

**When using the information given below and in the appropriate USEPA Regional Functional Guidelines, keep in mind that the validation action levels derived are sample-specific and must be adjusted for dilution, sample aliquot used for analysis, and sample moisture content (when applicable).**

The rules for qualifying data based on the occurrence of blank contamination vary based on regional protocols. The guidelines provided in the appropriate protocol should be followed.

Generally the blank contamination review process is completed by first considering the maximum amount of a particular contaminant occurring in the laboratory method blanks. (Do not consider lab blanks run after high concentration samples for purposes of determining carryover as laboratory method blanks!) Then repeat the process for contaminants occurring in the associated field quality control blanks. Action levels for qualification (10X or 5X depending upon whether or not the contaminant is a common contaminant) are then set. The list of common contaminants may vary among protocols. Additionally, some hierarchy among the field quality control blanks apply, and the manner in which the qualifiers are applied vary [i.e. use of (U) or (B); replacement by CRQL, etc.]. Refer to appropriate protocol for specific guidance.

1.1.6.4 Surrogates

Surrogates are evaluated by reviewing the laboratory data package Form II reports and the laboratory raw data. The quality control ranges are given on the laboratory data package Form IIs; circle any noncompliances on your working copies of these Forms.

Results for all compounds in an affected sample are qualified if any one of the surrogate spike compounds fail to meet the quality control criteria provided. Generally, for samples having a surrogate recovery <10%, positive results are qualified as estimated (J), nondetects are rejected (R). These results are biased low. For samples having a surrogate recovery which is low but >10%, positive results are generally qualified as estimated (J); nondetects (UJ). The bias qualifiers (L, UL) may be used instead, depending upon the specific USEPA Regional guidance. For samples having a surrogate recovery which is high, positive results are generally qualified as estimated (J, K) based on regional guidance, nondetects are not qualified based on high surrogate recovery.

1.1.6.5 Matrix Spike/Matrix Spike Duplicate (MS/MSD)

Generally, no data are qualified based upon MS/MSD results alone. If qualification does occur, generally only the result for that particular noncompliant compound is qualified in the original unspiked sample. Refer to the applicable data validation protocol for specific procedures for appropriately evaluating MS/MSD analyses.

1.1.6.6 Internal Standards

Internal standards are evaluated by reviewing the data package Form VIIIs and the laboratory raw data. The quality control ranges are given on the Form VIIIs. Circle any noncompliances on your working copies of these forms; evaluate and qualify as stipulated in the appropriate data validation protocol.

1.1.6.7 Tentatively Identified Compounds (TICs)

TICs are evaluated using the laboratory data package Form I VOA-TIC reports and the laboratory raw data. The guidance given in the March 1990 National Functional Guidelines for USEPA Region III is very concise; use the information in this document to evaluate and qualify accordingly.

1.1.6.8 Other Considerations

Laboratory precision can be evaluated by comparing the unspiked sample results with MS/MSD analyses results for unspiked compounds. Consider nondetects and results reported at concentrations less than

| TETRA TECH NUS, INC. | STANDARD OPERATING PROCEDURES | Number SA-1.3 | Page 1 of 20 |
|---|---|---|---|
| | | Effective Date 09/03 | Revision 7 |
| | | Applicability Tetra Tech NUS, Inc. | |
| | | Prepared Earth Sciences Department | |
| Subject SOIL SAMPLING | | Approved D. Senovich | |

## TABLE OF CONTENTS

**SECTION** **PAGE**



**ATTACHMENTS**

## 1.0 PURPOSE

This procedure discusses the methods used to collect surface, near surface, and subsurface soil samples. Additionally, it describes the method for sampling of test pits and trenches to determine subsurface soil and rock conditions, and recover small-volume or bulk samples.

## 2.0 SCOPE

This procedure is applicable to the collection of surface, near surface and subsurface soils for laboratory testing, which are exposed through hand digging, hand augering, drilling, or machine excavating at hazardous substance sites.

## 3.0 GLOSSARY

Composite Sample - A composite sample exists as a combination of more than one sample at various locations and/or depths and times, which is homogenized and treated as one sample. This type of sample is usually collected when determination of an average waste concentration for a specific area is required. Composite samples are not to be collected for volatile organics analysis.

Grab Sample - One sample collected at one location and at one specific time.

Non-Volatile Sample - A non-volatile sample includes all other chemical parameters (e.g., semivolatiles, pesticides/PCBs, metals, etc.) and those engineering parameters that do not require undisturbed soil for their analysis.

Hand Auger - A sampling device used to extract soil from the ground in a relatively undisturbed form.

Thin-Walled Tube Sampler - A thin-walled metal tube (also called a Shelby tube) used to recover relatively undisturbed soil samples. These tubes are available in various sizes, ranging from 2 to 5 inches outside diameter (OD) and from 18 to 54 inches in length.

Split-Barrel Sampler - A steel tube, split in half lengthwise, with the halves held together by threaded collars at either end of the tube. Also called a split-spoon sampler, this device can be driven into resistant materials using a drive weight mounted in the drilling string. A standard split-barrel sampler is typically available in two common lengths, providing either 20-inch or 26-inch longitudinal clearance for obtaining 18-inch or 24-inch-long samples, respectively. These split-barrel samplers commonly range in size from 2-inch OD to 3-1/2 inch OD. The larger sizes are commonly used when a larger volume of sample material is required.

Test Pit and Trench - Open, shallow excavations, typically rectangular (if a test pit) or longitudinal (if a trench), excavated to determine the shallow subsurface conditions for engineering, geological, and soil chemistry exploration and/or sampling purposes. These pits are excavated manually or by machine (e.g., backhoe, clamshell, trencher excavator, or bulldozer).

Confined Space - As stipulated in 29 CFR 1910.146, a confined space means a space that: 1) is large enough and so configured that an employee can bodily enter and perform assigned work; 2) has limited or restricted means for entry or exit (for example tanks, vessels, silos, storage bins, hoppers, vaults, pits, and excavations); and 3) is not designed for continuous employee occupancy. TtNUS considers all confined space as permit-required confined spaces.

## 4.0 RESPONSIBILITIES

Project Manager - The Project Manager is responsible for determining sampling objectives, as well as, the field procedures used in the collection of soil samples. Additionally, in consultation with other project personnel (geologist, hydrogeologist, etc.), the Project Manager establishes the need for test pits or trenches, and determines their approximate locations and dimensions.

Site Safety Officer (SSO) - The SSO (or a qualified designee) is responsible for providing the technical support necessary to implement the project Health and Safety Plan. This will include (but not be limited to) performing air quality monitoring during sampling, boring and excavation activities, and to ensure that workers and offsite (downwind) individuals are not exposed to hazardous levels of airborne contaminants. The SSO/designee may also be required to advise the FOL on other safety-related matters regarding boring, excavation and sampling, such as mitigative measures to address potential hazards from unstable trench walls, puncturing of drums or other hazardous objects, etc.

Field Operations Leader (FOL) - The FOL is responsible for finalizing the location of surface, near surface, and subsurface (hand and machine borings, test pits/trenches) soil samples. He/she is ultimately responsible for the sampling and backfilling of boreholes, test pits and trenches, and for adherence to OSHA regulations during these operations.

Project Geologist/Sampler - The project geologist/sampler is responsible for the proper acquisition of soil samples and the completion of all required paperwork (i.e., sample log sheets, field notebook, boring logs, test pit logs, container labels, custody seals, and chain-of-custody forms).

Competent Person - A Competent Person, as defined in 29 CFR 1929.650 of Subpart P - Excavations, means one who is capable of identifying existing and predictable hazards in the surroundings, or working conditions which are unsanitary, hazardous, or dangerous to employees, and who has authorization to take prompt corrective measures to eliminate them.

## 5.0 PROCEDURES

### 5.1 Overview

Soil sampling is an important adjunct to groundwater monitoring. Sampling of the soil horizons above the groundwater table can detect contaminants before they have migrated into the water table, and can establish the amount of contamination sorbed on aquifer solids that have the potential of contributing to groundwater contamination.

Soil types can vary considerably on a hazardous waste site. These variations, along with vegetation, can affect the rate of contaminant migration through the soil. It is important, therefore, that a detailed record be maintained during the sampling operations, particularly noting the location, depth, and such characteristics as grain size, color, and odor. Subsurface conditions are often stable on a daily basis and may demonstrate only slight seasonal variation especially with respect to temperature, available oxygen and light penetration. Changes in any of these conditions can radically alter the rate of chemical reactions or the associated microbiological community, thus further altering specific site conditions. As a result, samples must be kept at their at-depth temperature or lower, protected from direct light, sealed tightly in approved glass containers, and be analyzed as soon as possible.

The physical properties of the soil, its grain size, cohesiveness, associated moisture, and such factors as depth to bedrock and water table, will limit the depth from which samples can be collected and the method required to collect them. Often this information on soil properties can be obtained from published soil surveys available through the U.S. Geological Surveys and other government or farm agencies. It is the intent of this procedure to present the most commonly employed soil sampling methods used at hazardous waste sites.

## 5.2 Soil Sample Collection

### 5.2.1 Procedure for Collecting Soil Samples for Volatile Organic Compounds

The above described traditional sampling techniques, used for the collection of soil samples for volatile organic analysis, have recently been evaluated by the scientific community and determined to be ineffective in producing accurate results (biased low) due to the loss of volatile organics in the sampling stages and microbial degradation of aromatic volatiles. One of the newly adopted sampling procedures for collecting soil samples includes the field preservation of samples with methanol or sodium bisulfate to minimize volatilization and biodegradation. These preservation methods may be performed either in the field or laboratory, depending on the sampling methodology employed.

Soil samples to be preserved by the laboratory are currently being performed using method SW-846, 5035. Laboratories are currently performing low level analyses (sodium bisulfate preservation) and high level analyses (methanol preservation) depending on the end users needs.

It should be noted that a major disadvantage of the methanol preservation method is that the laboratory reporting limits will be higher than conventional testing. The reporting levels using the new method for most analytes are 0.5 µg/g for GC/MS and 0.05 µg/g for GC methods.

The alternative preservation method for collecting soil samples is with sodium bisulfate. This method is more complex to perform in the field and therefore is not preferred for field crews. It should also be noted that currently, not all laboratories have the capabilities to perform this analysis. The advantage to this method is that the reporting limits ( 0.001 µg/g for GC/PID or GC/ELCD, or 0.010 for GC/MS) are lower than those described above.

The following procedures outline the necessary steps for collecting soil samples to be preserved at the laboratory, and for collecting soil samples to be preserved in the field with methanol or sodium bisulfate.

#### 5.2.1.1 Soil Samples to be Preserved at the Laboratory

Soil samples collected for volatile organics that are to be preserved at the laboratory will be obtained using a hermetically sealed sample vial such as an EnCore™ sampler. Each sample will be obtained using a reusable sampling handle provided with the EnCore™ sampler. The sample is collected by pushing the EnCore™ sampler directly into the soil, ensuring that the sampler is packed tight with soil, leaving zero headspace. Using this type of sampling device eliminates the need for field preservation and the shipping restrictions associated with preservatives. A complete set of instructions is included with each Encore™ sampler shipment by the manufacturer.

Once the sample is collected, it should be placed on ice immediately and shipped to the laboratory within 48 hours (following the chain-of-custody and documentation procedures outlined in SOP SA-6.1). Samples must be preserved by the laboratory within 48 hours of sample collection.

If the lower detection limits are necessary, an option would be to collect several EnCore™ samplers at a given sample location. Send all samplers to the laboratory and the laboratory can perform the required preservation and analyses.

5.2.1.2 Soil Samples to be Preserved in the Field

Soil samples preserved in the field may be prepared for analyses using both the low-level (sodium bisulfate preservation) method and medium-level (methanol preservation) method.

Methanol Preservation (Medium Level):

Soil samples to be preserved in the field with methanol will utilize 40-60 mL glass vials with septum lids. Each sample bottle will be filled with 25 mL of demonstrated analyte-free purge and trap grade methanol. Bottles may be prespiked with methanol in the laboratory or prepared in the field.

Soil will be collected with the use of a decontaminated (or disposable), small-diameter coring device such as a disposable tube/plunger-type syringe with the tip cut off. The outside diameter of the coring device must be smaller than the inside diameter of the sample bottle neck.

A small electronic balance or manual scale will be necessary for measuring the volume of soil to be added to the methanol preserved sample bottle. Calibration of the scale should be performed prior to use and intermittently throughout the day according to the manufacturers requirements.

The sample should be collected by pulling the plunger back and inserting the syringe into the soil to be sampled. The top several inches of soil should be removed before collecting the sample. Approximately 10 grams ±2g (8-12 grams) of soil should be collected. The sample should be weighed and adjusted until obtaining the required amount of sample. The sample weight should be recorded to the nearest 0.01 gram in the field logbook and/or sample log sheet. The soil should then be extruded into the methanol preserved sample bottle taking care not to contact the sample container with the syringe. The threads of the bottle and cap must be free of soil particles.

After capping the bottle, swirl the sample (do not shake) in the methanol and break up the soil such that all of the soil is covered with methanol. Place the sample on ice immediately and prepare for shipment to the laboratory as described in SOP SA-6.1.

Sodium Bisulfate Preservation (Low Level):

Samples to be preserved using the sodium bisulfate method are to be prepared as follows:

Add 1 gram of sodium bisulfate to 5 mL of laboratory grade deionized water in a 40-60 mL glass vial with septum lid. Bottles may be prespiked in the laboratory or prepared in the field. The soil sample should be collected in a manner as described above and added to the sample container. The sample should be weighed to the nearest 0.01 gram as described above and recorded in the field logbook or sample log sheet.

Care should be taken when adding the soil to the sodium bisulfate solution. A chemical reaction of soils containing carbonates (limestone) may cause the sample to effervesce or the vial to possibly explode.

When preparing samples using the sodium bisulfate preservation method, duplicate samples must be collected using the methanol preservation method on a one for one sample basis. The reason for this is because it is necessary for the laboratory to perform both the low level and medium level analyses. Place the sample on ice immediately and prepare for shipment to the laboratory as described in SOP SA-6.1.

If the lower detection limits are necessary, an option to field preserving with sodium bisulfate would be to collect 3 EnCore™ samplers at a given sample location. Send all samplers to the laboratory and the laboratory can perform the required preservation and analyses.

### 5.2.2 Procedure for Collecting Non-Volatile Soil Samples

Non-volatile soil samples may be collected as either grab or composite samples. The non-volatile soil sample is thoroughly mixed in a stainless steel or disposable, inert plastic tray, using a stainless steel trowel or other approved tool, then transferred into the appropriate sample container(s). Head space is permitted in a non-volatile soil sample container to allow for sample expansion.

### 5.2.3 Procedure for Collecting Undisturbed Soil Samples (ASTM D1587-83)

When it is necessary to acquire undisturbed samples of soil for purposes of engineering parameter analysis (e.g., permeability), a thin-walled, seamless tube sampler (Shelby tube) will be employed. The following method will be used:

1. Remove all surface debris (e.g., vegetation, roots, twigs, etc.) from the specific sampling location and drill and clean out the borehole to the sampling depth, being careful to minimize the chance for disturbance of the material to be sampled. In saturated material, withdraw the drill bit slowly to prevent loosening of the soil around the borehole and to maintain the water level in the hole at or above groundwater level.

2. The use of bottom discharge bits or jetting through an open-tube sampler to clean out the borehole shall not be allowed. Use of any side-discharge bits is permitted.

3. A stationary piston-type sampler may be required to limit sample disturbance and aid in retaining the sample. Either the hydraulically operated or control rod activated-type of stationary piston sampler may be used. Prior to inserting the tube sampler into the borehole, check to ensure that the sampler head contains a check valve. The check valve is necessary to keep water in the rods from pushing the sample out the tube sampler during sample withdrawal and to maintain a suction within the tube to help retain the sample.

4. To minimize chemical reaction between the sample and the sampling tube, brass tubes may be required, especially if the tube is stored for an extended time prior to testing. While steel tubes coated with shellac are less expensive than brass, they're more reactive, and shall only be used when the sample will be tested within a few days after sampling or if chemical reaction is not anticipated. With the sampling tube resting on the bottom of the hole and the water level in the boring at groundwater level or above, push the tube into the soil by a continuous and rapid motion, without impacting or twisting. In no case shall the tube be pushed farther than the length provided for the soil sample. Allow about 3 inches in the tube for cuttings and sludge.

5. Upon removal of the sampling tube from the hole, measure the length of sample in the tube and also the length penetrated. Remove disturbed material in the upper end of the tube and measure the length of sample again. After removing at least an inch of soil from the lower end and after inserting an impervious disk, seal both ends of the tube with at least a 1/2-inch thickness of wax applied in a way that will prevent the wax from entering the sample. Clean filler must be placed in voids at either end of the tube prior to sealing with wax. Place plastic caps on the ends of the sample tube, tape the caps in place, and dip the ends in wax.

6. Affix label(s) to the tube as required and record sample number, depth, penetration, and recovery length on the label. Mark the "up" direction on the side of the tube with indelible ink, and mark the end of the sample. Complete Chain-of-Custody (see SOP SA-6.3) and other required forms (including Attachment A of this SOP). Do not allow tubes to freeze, and store the samples vertically with the same orientation they had in the ground, (i.e., top of sample is up) in a cool place out of the sun at all times. Ship samples protected with suitable resilient packing material to reduce shock, vibration, and disturbance.

Thin-walled undisturbed tube samplers are restricted in their usage by the consistency of the soil to be sampled. Often, very loose and/or wet samples cannot be retrieved by the samplers, and soils with a consistency in excess of very stiff cannot be penetrated by the sampler. Devices such as Dennison or Pitcher core samplers can be used to obtain undisturbed samples of stiff soils. Using these devices normally increases sampling costs, and therefore their use shall be weighed against the need for acquiring an undisturbed sample.

## 5.3 Surface Soil Sampling

The simplest, most direct method of collecting surface soil samples (most commonly collected to a depth of 6 inches) for subsequent analysis is by use of a stainless steel trowel. Surface soils are considered 0-12 inches bgs.

In general, the following equipment is necessary for obtaining surface soil samples:

- Stainless steel or pre-cleaned disposable trowel.
- Real-time air monitoring instrument (e.g., PID, FID, etc.).
- Latex gloves.
- Required Personal Protective Equipment (PPE).
- Required paperwork (see SOP SA-6.3 and Attachment A of this SOP).
- Required decontamination equipment.
- Required sample container(s).
- Wooden stakes or pin flags.
- Sealable polyethylene bags (i.e., Ziploc® baggies).
- Heavy duty cooler.
- Ice.
- Chain-of-custody records and custody seals.

When acquiring surface soil samples, the following procedure shall be used:

1. Carefully remove vegetation, roots, twigs, litter, etc., to expose an adequate soil surface area to accommodate sample volume requirements.

2. Using a decontaminated stainless steel trowel, follow the procedure cited in Section 5.2.1 for collecting a volatile soil sample. Surface soil samples for volatile organic analysis should be collected from 6-12 inches bgs only.

3. Thoroughly mix (in-situ) a sufficient amount of soil to fill the remaining sample containers and transfer the sample into those containers utilizing the same stainless steel trowel employed above. Cap and securely tighten all sample containers.

4. Affix a sample label to each container. Be sure to fill out each label carefully and clearly, addressing all the categories described in SOP SA-6.3.

5. Proceed with the handling and processing of each sample container as described in SOP SA-6.2.

## 5.4 Near-Surface Soil Sampling

Collection of samples from near the surface (depth of 6-18 inches) can be accomplished with tools such as shovels and stainless steel or pre-cleaned disposable trowels.

The following equipment is necessary to collect near surface soil samples:

- Clean shovel.
- The equipment listed under Section 5.3 of this procedure.
- Hand auger.

To obtain near-surface soil samples, the following protocol shall be observed:

1. With a clean shovel, make a series of vertical cuts to the depth required in the soil to form a square approximately 1 foot by 1 foot.

2. Lever out the formed plug and scrape the bottom of the freshly dug hole with a decontaminated stainless steel or pre-cleaned disposable trowel to remove any loose soil.

3. Follow steps 2 through 5 listed under Section 5.3 of this procedure.

### 5.5 Subsurface Soil Sampling With a Hand Auger

A hand augering system generally consists of a variety of all stainless steel bucket bits (i.e., cylinders 6-1/2" long, and 2-3/4", 3-1/4", and 4" in diameter), a series of extension rods (available in 2', 3', 4' and 5' lengths), and a cross handle. A larger diameter bucket bit is commonly used to bore a hole to the desired sampling depth and then withdrawn. In turn, the larger diameter bit is replaced with a smaller diameter bit, lowered down the hole, and slowly turned into the soil at the completion depth (approximately 6 inches). The apparatus is then withdrawn and the soil sample collected.

The hand auger can be used in a wide variety of soil conditions. It can be used to sample soil both from the surface, or to depths in excess of 12 feet. However, the presence of rock layers and the collapse of the borehole normally contribute to its limiting factors.

To accomplish soil sampling using a hand augering system, the following equipment is required:

- Complete hand auger assembly (variety of bucket bit sizes).
- Stainless steel mixing bowls.
- The equipment listed under Section 5.3 of this procedure.

To obtain soil samples using a hand auger, the following procedure shall be followed:

1. Attach a properly decontaminated bucket bit to a clean extension rod and further attach the cross handle to the extension rod.

2. Clear the area to be sampled of any surface debris (vegetation, twigs, rocks, litter, etc.).

3. Begin augering (periodically removing accumulated soils from the bucket bit) and add additional rod extensions as necessary. Also, note (in a field notebook, boring log, and/or on standardized data sheets) any changes in the color, texture or odor of the soil.

4. After reaching the desired depth, slowly and carefully withdraw the apparatus from the borehole.

5. Remove the soiled bucket bit from the rod extension and replace it with another properly decontaminated bucket bit. The bucket bit used for sampling is commonly smaller in diameter than the bucket bit employed to initiate the borehole.

6. Carefully lower the apparatus down the borehole. Care must be taken to avoid scraping the borehole sides.

7. Slowly turn the apparatus until the bucket bit is advanced approximately 6 inches.

8. Discard the top of the core (approximately 1"), which represents any loose material collected by the bucket bit before penetrating the sample material.

9. Fill volatile sample container(s), using a properly decontaminated stainless steel trowel, with sample material directly from the bucket bit. Refer to Section 5.2.1 of this procedure.

10. Utilizing the above trowel, remove the remaining sample material from the bucket bit and place into a properly decontaminated stainless steel mixing bowl and thoroughly homogenize the sample material prior to filling the remaining sample containers. Refer to Section 5.2.2 of this procedure.

11. Follow steps 4 and 5 listed under Section 5.3 of this procedure.

### 5.6 Subsurface Soil Sampling With a Split-Barrel Sampler (ASTM D1586-84)

Split-barrel (split-spoon) samplers consist of a heavy carbon steel or stainless steel sampling tube that can be split into two equal halves to reveal the soil sample (see Attachment B). A drive head is attached to the upper end of the tube and serves as a point of attachment for the drill rod. A removable tapered nosepiece/drive shoe attaches to the lower end of the tube and facilitates cutting. A basket-like sample retainer can be fitted to the lower end of the split tube to hold loose, dry soil samples in the tube when the sampler is removed from the drill hole. This split-barrel sampler is made to be attached to a drill rod and forced into the ground by means of a 140-lb. or larger casing driver.

Split-barrel samplers are used to collect soil samples from a wide variety of soil types and from depths greater than those attainable with other soil sampling equipment.

The following equipment is used for obtaining split-barrel samples:

- Drilling equipment (provided by subcontractor).
- Split-barrel samplers (O.D. 2 inches, I.D. 1-3/8 inches, either 20 inches or 26 inches long); Larger O.D. samplers are available if a larger volume of sample is needed.
- Drive weight assembly, 140-lb. weight, driving head and guide permitting free fall of 30 inches.
- Stainless steel mixing bowls.
- Equipment listed under Section 5.3 of this procedure.

The following steps shall be followed to obtain split-barrel samples:

1. Remove the drive head and nosepiece, and open the sampler to reveal the soil sample. Immediately scan the sample core with a real-time air monitoring instrument (e.g., FID, PID, etc.). Carefully separate the soil core, with a decontaminated stainless steel knife or trowel, at about 6-inch intervals while scanning the center of the core for elevated readings. Also scan stained soil, soil lenses, and anomalies (if present), and record readings.

2. Collect the volatile sample from the center of the core where elevated readings occurred. If no elevated readings where encountered the sample material should still be collected from the core's

center (this area represents the least disturbed area with minimal atmospheric contact). Refer to Section 5.2.1 of this procedure.

3. Using the same trowel, remove remaining sample material from the split-barrel sampler (except for the small portion of disturbed soil usually found at the top of the core sample) and place the soil into a decontaminated stainless steel mixing bowl. Thoroughly homogenize the sample material prior to filling the remaining sample containers. Refer to Section 5.2.2 of this procedure.

4. Follow steps 4 and 5 listed under Section 5.3 of this procedure.

## 5.7 Subsurface Sol Sampling Using Direct Push Technology

Subsurface soil samples can be collected to depths of 40+ feet using direct push technology (DPT). DPT equipment, responsibilities, and procedures are described in SOP SA-2.5.

## 5.8 Excavation and Sampling of Test Pits and Trenches

### 5.8.1 Applicability

This subsection presents routine test pit or trench excavation techniques and specialized techniques that are applicable under certain conditions.

During the excavation of trenches or pits at hazardous waste sites, several health and safety concerns arise which control the method of excavation. No personnel shall enter any test pit or excavation over 4 feet deep except as a last resort, and then only under direct supervision of a Competent Person (as defined in 29 CFR 1929.650 of Subpart P - Excavations). Whenever possible, all required chemical and lithological samples should be collected using the excavator bucket or other remote sampling apparatus. If entrance is still required, all test pits or excavations must be stabilized by bracing the pit sides using specifically designed wooden or steel support structures. Personnel entering the excavation may be exposed to toxic or explosive gases and oxygen-deficient environments. Any entry may constitute a Confined Space and must be done in conformance with all applicable regulations. In these cases, substantial air monitoring is required before entry, and appropriate respiratory gear and protective clothing is mandatory. There must be at least two persons present at the immediate site before entry by one of the investigators. The reader shall refer to OSHA regulations 29 CFR 1926, 29 CFR 1910.120, 29 CFR 1910.134, and 29 CFR 1910.146.

Excavations are generally not practical where a depth of more than about 15 feet is desired, and they are usually limited to a few feet below the water table. In some cases, a pumping system may be required to control water levels within the pit, providing that pumped water can be adequately stored or disposed. If data on soils at depths greater than 15 feet are required, the data are usually obtained through test borings instead of test pits.

In addition, hazardous wastes may be brought to the surface by excavation equipment. This material, whether removed from the site or returned to the subsurface, must be properly handled according to any and all applicable federal, state, and local regulations.

### 5.8.2 Test Pit and Trench Excavation

These procedures describe the methods for excavating and logging test pits and trenches excavated to determine subsurface soil and rock conditions. Test pit operations shall be logged and documented (see Attachment C).

Test pits and trenches may be excavated by hand or by power equipment to permit detailed description of the nature and contamination of the in-situ materials. The size of the excavation will depend primarily on the following:

- The purpose and extent of the exploration.
- The space required for efficient excavation.
- The chemicals of concern.
- The economics and efficiency of available equipment.

Test pits normally have a cross section that is 4 to 10 feet square; test trenches are usually 3 to 6 feet wide and may be extended for any length required to reveal conditions along a specific line. The following table, which is based on equipment efficiencies, gives a rough guide for design consideration:

| Equipment | Typical Widths, in Feet |
|---|---|
| Trenching machine | 2 |
| Backhoe | 2-6 |
| Track dozer | 10 |
| Track loader | 10 |
| Excavator | 10 |
| Scraper | 20 |

The lateral limits of excavation of trenches and the position of test pits shall be carefully marked on area base maps. If precise positioning is required to indicate the location of highly hazardous waste materials, nearby utilities, or dangerous conditions, the limits of the excavation shall be surveyed. Also, if precise determination of the depth of buried materials is needed for design or environmental assessment purposes, the elevation of the ground surface at the test pit or trench location shall also be determined by survey. If the test pit/trench will not be surveyed immediately, it shall be backfilled and its position identified with stakes placed in the ground at the margin of the excavation for later surveying.

The construction of test pits and trenches shall be planned and designed in advance as much as possible. However, field conditions may necessitate revisions to the initial plans. The final depth and construction method shall be determined by the field geologist. The actual layout of each test pit, temporary staging area, and spoils pile will be predicated based on site conditions and wind direction at the time the test pit is made. Prior to excavation, the area can be surveyed by magnetometer or metal detector to identify the presence of underground utilities or drums.

As mentioned previously, no personnel shall enter any test pit or excavation except as a last resort, and then only under direct supervision of a Competent Person. If entrance is still required, Occupational Safety and Health Administration (OSHA) requirements must be met (e.g., walls must be braced with wooden or steel braces, ladders must be in the hole at all times, and a temporary guardrail must be placed along the surface of the hole before entry). It is emphasized that the project data needs should be structured such that required samples can be collected without requiring entrance into the excavation. For example, samples of leachate, groundwater, or sidewall soils can be taken with telescoping poles, etc.

Dewatering may be required to assure the stability of the side walls, to prevent the bottom of the pit from heaving, and to keep the excavation dry. This is an important consideration for excavations in cohesionless material below the groundwater table. Liquids removed as a result of dewatering operations must be handled as potentially contaminated materials. Procedures for the collection and disposal of such materials should be discussed in the site-specific project plans.

### 5.8.3 Sampling in Test Pits and Trenches

#### 5.8.3.1 General

Test pits and trenches are usually logged as they are excavated. Records of each test pit/trench will be made as presented in Attachment C. These records include plan and profile sketches of the test pit/trench showing materials encountered, their depth and distribution in the pit/trench, and sample locations. These records also include safety and sample screening information.

Entry of test pits by personnel is extremely dangerous, shall be avoided unless absolutely necessary, and can occur only after all applicable Health and Safety and OSHA requirements have been met.

The final depth and type of samples obtained from each test pit will be determined at the time the test pit is excavated. Sufficient samples are usually obtained and analyzed to quantify contaminant distribution as a function of depth for each test pit. Additional samples of each waste phase and any fluids encountered in each test pit may also be collected.

In some cases, samples of soil may be extracted from the test pit for reasons other than waste sampling and chemical analysis, for instance, to obtain geotechnical information. Such information would include soil types, stratigraphy, strength, etc., and could therefore entail the collection of disturbed (grab or bulk) or relatively undisturbed (hand-carved or pushed/driven) samples, which can be tested for geotechnical properties. The purposes of such explorations are very similar to those of shallow exploratory or test borings, but often test pits offer a faster, more cost-effective method of sampling than installing borings.

#### 5.8.3.2 Sampling Equipment

The following equipment is needed for obtaining samples for chemical or geotechnical analysis from test pits and trenches:

- Backhoe or other excavating machinery.
- Shovels, picks, hand augers, and stainless steel trowels/disposable trowels.
- Sample container - bucket with locking lid for large samples; appropriate bottleware for chemical or geotechnical analysis samples.
- Polyethylene bags for enclosing sample containers; buckets.
- Remote sampler consisting of 10-foot sections of steel conduit (1-inch-diameter), hose clamps and right angle adapter for conduit (see Attachment D).

#### 5.8.3.3 Sampling Methods

The methods discussed in this section refer to test pit sampling from grade level. If test pit entry is required, see Section 5.8.3.4.

- Excavate trench or pit in several depth increments. After each increment, the operator will wait while the sampler inspects the test pit from grade level to decide if conditions are appropriate for sampling. (Monitoring of volatiles by the SSO will also be used to evaluate the need for sampling.) Practical depth increments range from 2 to 4 feet.

- The backhoe operator, who will have the best view of the test pit, will immediately cease digging if:

  - Any fluid phase or groundwater seepage is encountered in the test pit.
  - Any drums, other potential waste containers, obstructions or utility lines are encountered.
  - Distinct changes of material are encountered.

This action is necessary to permit proper sampling of the test pit and to prevent a breach of safety protocol. Depending upon the conditions encountered, it may be required to excavate more slowly and carefully with the backhoe.

For obtaining test pit samples from grade level, the following procedure shall be followed:

- Remove loose material to the greatest extent possible with backhoe.

- Secure walls of pit if necessary. (There is seldom any need to enter a pit or trench which would justify the expense of shoring the walls. All observations and samples should be taken from the ground surface.)

- Samples of the test pit material are to be obtained either directly from the backhoe bucket or from the material once it has been deposited on the ground. The sampler or Field Operations Leader directs the backhoe operator to remove material from the selected depth or location within the test pit/trench. The bucket is brought to the surface and moved away from the pit. The sampler and/or SSO then approaches the bucket and monitors its contents with a photoionization or flame ionization detector. The sample is collected from the center of the bucket or pile and placed in sample containers using a decontaminated stainless steel trowel or disposable spatula.

- If a composite sample is desired, several depths or locations within the pit/trench are selected and a bucket is filled from each area. It is preferable to send individual sample bottles filled from each bucket to the laboratory for compositing under the more controlled laboratory conditions. However, if compositing in the field is required, each sample container shall be filled from materials that have been transferred into a mixing bucket and homogenized. Note that homogenization/compositing is not applicable for samples to be subjected to volatile organic analysis.

- Using the remote sampler shown in Attachment D, samples can be taken at the desired depth from the side wall or bottom of the pit. The face of the pit/trench shall first be scraped (using a long-handled shovel or hoe) to remove the smeared zone that has contacted the backhoe bucket. The sample shall then be collected directly into the sample jar, by scraping with the jar edge, eliminating the need to utilize samplers and minimizing the likelihood of cross-contamination. The sample jar is then capped, removed from the assembly, and packaged for shipment.

- Complete documentation as described in SOP SA-6.3 and Attachment C of this SOP.

5.8.3.4 In-Pit Sampling

Under rare conditions, personnel may be required to enter the test pit/trench. This is necessary only when soil conditions preclude obtaining suitable samples from the backhoe bucket (e.g., excessive mixing of soils or wastes within the test pit/trench) or when samples from relatively small discrete zones within the test pit are required. This approach may also be necessary to sample any seepage occurring at discrete levels or zones in the test pit that are not accessible with remote samplers.

In general, personnel shall sample and log pits and trenches from the ground surface, except as provided for by the following criteria:

- There is no practical alternative means of obtaining such data.

- The Site Safety Officer and Competent Person determines that such action can be accomplished without breaching site safety protocol. This determination will be based on actual monitoring of the pit/trench after it is dug (including, at a minimum, measurements of volatile organics, explosive gases and available oxygen).

- A Company-designated Competent Person determines that the pit/trench is stable or is made stable (by grading the sidewalls or using shoring) prior to entrance of any personnel. OSHA requirements must be strictly observed.

If these conditions are satisfied, one person will enter the pit/trench. On potentially hazardous waste sites, this individual will be dressed in safety gear as required by the conditions in the pit. He/she will be affixed to a safety rope and continuously monitored while in the pit.

A second individual will be fully dressed in protective clothing including a self-contained breathing device and on standby during all pit entry operations. The individual entering the pit will remain therein for as brief a period as practical, commensurate with performance of his/her work. After removing the smeared zone, samples shall be obtained with a decontaminated trowel or spoon. As an added precaution, it is advisable to keep the backhoe bucket in the test pit when personnel are working below grade. Such personnel can either stand in or near the bucket while performing sample operations. In the event of a cave-in they can either be lifted clear in the bucket, or at least climb up on the backhoe arm to reach safety.

5.8.3.5 Geotechnical Sampling

In addition to the equipment described in Section 5.8.3.2, the following equipment is needed for geotechnical sampling:

- Soil sampling equipment, similar to that used in shallow drilled boring (i.e., open tube samplers), which can be pushed or driven into the floor of the test pit.

- Suitable driving (i.e., a sledge hammer) or pushing (i.e., the backhoe bucket) equipment which is used to advance the sampler into the soil.

- Knives, spatulas, and other suitable devices for trimming hand-carved samples.

- Suitable containers (bags, jars, tubes, boxes, etc.), labels, wax, etc. for holding and safely transporting collected soil samples.

- Geotechnical equipment (pocket penetrometer, torvane, etc.) for field testing collected soil samples for classification and strength properties.

Disturbed grab or bulk geotechnical soil samples may be collected for most soils in the same manner as comparable soil samples for chemical analysis. These collected samples may be stored in jars or plastic-lined sacks (larger samples), which will preserve their moisture content. Smaller samples of this type are usually tested for their index properties to aid in soil identification and classification, while larger bulk samples are usually required to perform compaction tests.

Relatively undisturbed samples are usually extracted in cohesive soils using open tube samplers, and such samples are then tested in a geotechnical laboratory for their strength, permeability and/or compressibility. The techniques for extracting and preserving such samples are similar to those used in performing Shelby tube sampling in borings, except that the sampler is advanced by hand or backhoe, rather than by a drill rig. Also, the sampler may be extracted from the test pit by excavation around the sampler when it is difficult to pull it out of the ground. If this excavation requires entry of the test pit, the requirements described in Section 5.8.3.4 of this procedure must be followed. The open tube sampler shall be pushed or driven vertically into the floor or steps excavated in the test pit at the desired sampling elevations. Extracting tube samples horizontally from the walls of the test pit is not appropriate, because the sample will not have the correct orientation.

A sledge hammer or the backhoe may be used to drive or push the sampler or tube into the ground. Place a piece of wood over the top of the sampler or sampling tube to prevent damage during driving/pushing of the sample. Pushing the sampler with a constant thrust is always preferable to driving it with repeated blows, thus minimizing disturbance to the sample. If the sample cannot be extracted by rotating it at least two revolutions (to shear off the sample at the bottom), hand-excavate to remove the soil from around the sides of the sampler. If hand-excavation requires entry of the test pit, the requirements in Section 5.8.3.4 of this procedure must be followed. Prepare, label, pack and transport the sample in the required manner, as described in SOP SA-6.3 and SA-6.1.

#### 5.8.4 Backfilling of Trenches and Test Pits

All test pits and excavations must be either backfilled, covered, or otherwise protected at the end of each day. No excavations shall remain open during non-working hours unless adequately covered or otherwise protected.

Before backfilling, the onsite crew shall photograph all significant features exposed by the test pit and trench and shall include in the photograph a scale to show dimensions. Photographs of test pits shall be marked to include site number, test pit number, depth, description of feature, and date of photograph. In addition, a geologic description of each photograph shall be entered in the site logbook. All photographs shall be indexed and maintained as part of the project file for future reference.

After inspection, backfill material shall be returned to the pit under the direction of the FOL.

If a low permeability layer is penetrated (resulting in groundwater flow from an upper contaminated flow zone into a lower uncontaminated flow zone), backfill material must represent original conditions or be impermeable. Backfill could consist of a soil-bentonite mix prepared in a proportion specified by the FOL (representing a permeability equal to or less than original conditions). Backfill can be covered by "clean" soil and graded to the original land contour. Revegetation of the disturbed area may also be required.

### 5.9 Records

The appropriate sample log sheet (see Attachment A of this SOP) must be completed by the site geologist/sampler. All soil sampling locations should be documented by tying in the location of two or more nearby permanent landmarks (building, telephone pole, fence, etc.) or obtaining GPS coordinates; and shall be noted on the appropriate sample log sheet, site map, or field notebook. Surveying may also be necessary, depending on the project requirements.

Test pit logs (see Attachment C of this SOP) shall contain a sketch of pit conditions. In addition, at least one photograph with a scale for comparison shall be taken of each pit. Included in the photograph shall be a card showing the test pit number. Boreholes, test pits and trenches shall be logged by the field geologist in accordance with SOP GH-1.5.

Other data to be recorded in the field logbook include the following:

- Name and location of job.
- Date of boring and excavation.

- Approximate surface elevation.
- Total depth of boring and excavation.
- Dimensions of pit.
- Method of sample acquisition.
- Type and size of samples.
- Soil and rock descriptions.
- Photographs.
- Groundwater levels.
- Organic gas or methane levels.
- Other pertinent information, such as waste material encountered.

## 6.0 REFERENCES

American Society for Testing and Materials, 1987. ASTM Standards D1587-83 and D1586-84. ASTM Annual Book of Standards. ASTM. Philadelphia, Pennsylvania. Volume 4.08.

NUS Corporation, 1986. Hazardous Material Handling Training Manual.

NUS Corporation and CH2M Hill, August, 1987. Compendium of Field Operation Methods. Prepared for the U.S. EPA.

OSHA, Excavation, Trenching and Shoring 29 CFR 1926.650-653.

OSHA, Confined Space Entry 29 CFR 1910.146.

## ATTACHMENT A
## SOIL & SEDIMENT SAMPLE LOG SHEET

Tetra Tech NUS, Inc.

**SOIL & SEDIMENT SAMPLE LOG SHEET**

Page___ of ___

Project Site Name: ____________
Project No.: ____________

[] Surface Soil
[] Subsurface Soil
[] Sediment
[] Other:
[] QA Sample Type: ____________

Sample ID No.: ____________
Sample Location: ____________
Sampled By: ____________
C.O.C. No.: ____________

Type of Sample:
[] Low Concentration
[] High Concentration

**GRAB SAMPLE DATA:**

| | Depth | Color | Description (Sand, Silt, Clay, Moisture, etc.) |
|---|---|---|---|
| Date: | | | |
| Time: | | | |
| Method: | | | |
| Monitor Reading (ppm): | | | |

**COMPOSITE SAMPLE DATA:**

| | Time | Depth | Color | Description (Sand, Silt, Clay, Moisture, etc.) |
|---|---|---|---|---|
| Date: | | | | |
| Method: | | | | |
| Monitor Readings (Range in ppm): | | | | |

**SAMPLE COLLECTION INFORMATION:**

| Analysis | Container Requirements | Collected | Other |
|---|---|---|---|
| | | | |

**OBSERVATIONS / NOTES:**

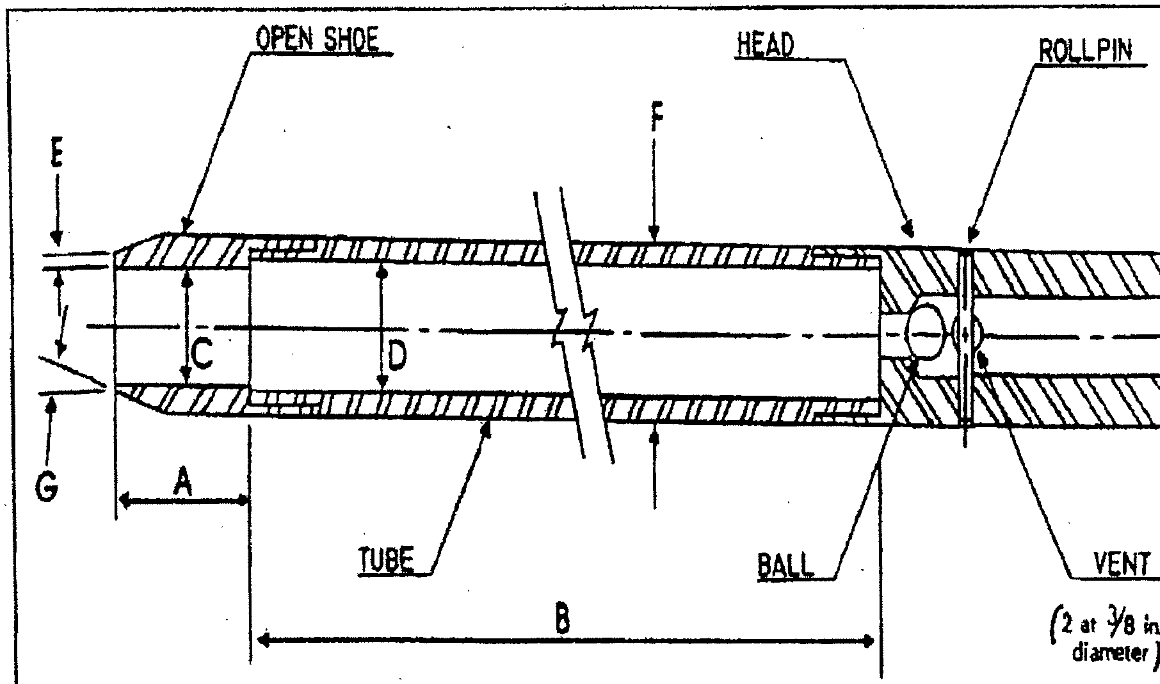
**MAP:**

**Circle if Applicable:**

| MS/MSD | Duplicate ID No.: |
|---|---|
| | |

Signature(s):

## ATTACHMENT B
## SPLIT-SPOON SAMPLER




A = 1.0 to 2.0 in. (25 to 50 mm)
B = 18.0 to 30.0 in. (0.457 to 0.762 m)
C = 1.375 ± 0.005 in. (34.93 ± 0.13 mm)
D = 1.50 ± 0.05 – 0.00 in. (38.1 ± 1.3 – 0.0 mm)
E = 0.10 ± 0.02 in. (2.54 ± 0.25 mm)
F = 2.00 ± 0.05 – 0.00 in. (50.8 ± 1.3 – 0.0 mm)
G = 16.0° to 23.0°

The 1½ in. (38 mm) inside diameter split barrel may be used with a 16-gage wall thickness split liner. The penetrating end of the drive shoe may be slightly rounded. Metal or plastic retainers may be used to retain soil samples.

**ATTACHMENT C**
**TEST PIT LOG**

Tetra Tech NUS, Inc.

**TEST PIT LOG**

Page ___ of ___

PROJECT NAME:
PROJECT NUMBER:
LOCATION:

TEST PIT No.:
DATE:
GEOLOGIST:

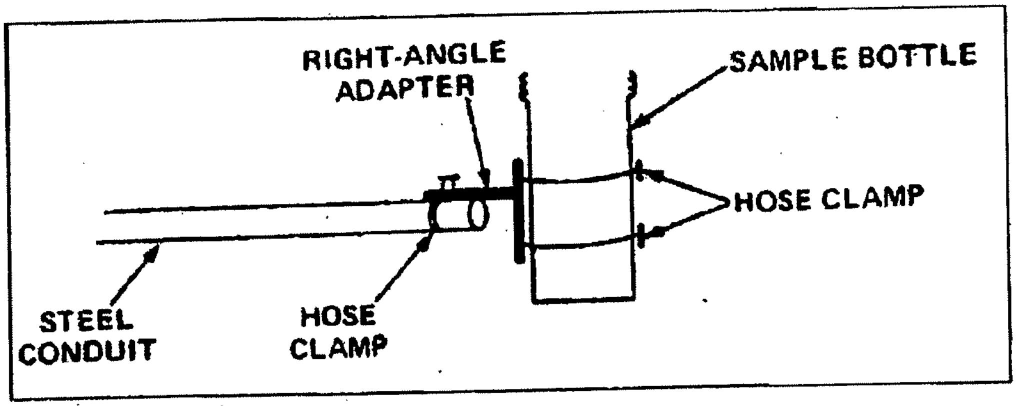
| Depth (Ft.) | Lithology Change (Depth/Ft.) | MATERIAL DESCRIPTION Soil/Waste Characteristics (lithology, density, color, etc.) | USCS | Remarks | PID/FID READING Source (ppm) | PID/FID READING Sample (ppm) |
|---|---|---|---|---|---|---|
| | | | | | | |
| | | | | | | |
| | | | | | | |
| | | | | | | |
| | | | | | | |
| | | | | | | |
| | | | | | | |
| | | | | | | |
| | | | | | | |
| | | | | | | |
| | | | | | | |
| | | | | | | |
| | | | | | | |
| | | | | | | |
| | | | | | | |
| | | | | | | |
| | | | | | | |
| | | | | | | |

TEST PIT CROSS SECTION AND / OR PLAN VIEW

REMARKS:

PHOTO LOG:

## ATTACHMENT D
## REMOTE SAMPLE HOLDER FOR TEST PIT/TRENCH SAMPLING



| TETRA TECH NUS, INC. | STANDARD OPERATING PROCEDURES | Number SA-6.1 | Page 1 of 11 |
|---|---|---|---|
| | | Effective Date 02/04 | Revision 3 |
| | | Applicability Tetra Tech NUS, Inc. | |
| | | Prepared Earth Sciences Department | |
| Subject NON-RADIOLOGICAL SAMPLE HANDLING | | Approved D. Senovich | |

## TABLE OF CONTENTS

**SECTION** **PAGE**



**ATTACHMENTS**

## 1.0 PURPOSE

The purpose of this Standard Operating Procedure (SOP) is to provide information on sample preservation, packaging, and shipping procedures to be used in handling environmental samples submitted for chemical constituent, biological, or geotechnical analysis. Sample chain-of-custody procedures and other aspects of field documentation are addressed in SOP SA-6.3. Sample identification is addressed in SOP CT-04.

## 2.0 SCOPE

This procedure describes the appropriate containers to be used for samples depending on the analyses to be performed, and the steps necessary to preserve the samples when shipped off site for chemical analysis.

## 3.0 GLOSSARY

Hazardous Material - A substance or material which has been determined by the Secretary of Transportation to be capable of posing an unreasonable risk to health, safety, and property when transported in commerce, and which has been so designated. Under 49 CFR, the term includes hazardous substances, hazardous wastes, marine pollutants, and elevated temperature materials, as well as materials designated as hazardous under the provisions of §172.101 and §172.102 and materials that meet the defining criteria for hazard classes and divisions in Part 173. With slight modifications, IATA has adopted DOT "hazardous materials" as IATA "Dangerous Goods."

Hazardous Waste - Any substance listed in 40 CFR, Subpart D (ý261.30 et seq.), or otherwise characterized as ignitable, corrosive, reactive, or toxic (as defined by Toxicity Characteristic Leaching Procedure, TCLP, analysis) as specified under 40 CFR, Subpart C (ý261.20 et seq.), that would be subject to manifest requirements specified in 40 CFR 262. Such substances are defined and regulated by EPA.

Marking - A descriptive name, identification number, instructions, cautions, weight, specification or UN marks, or combination thereof required on outer packaging of hazardous materials.

n.o.i - Not otherwise indicated (may be used interchangeably with n.o.s.).

n.o.s. - Not otherwise specified.

Packaging - A receptacle and any other components or materials necessary for compliance with the minimum packaging requirements of 49 CFR 174, including containers (other than freight containers or overpacks), portable tanks, cargo tanks, tank cars, and multi-unit tank-car tanks to perform a containment function in conformance with the minimum packaging requirements of 49 CFR 173.24(a) & (b).

Placard - Color-coded, pictorial sign which depicts the hazard class symbol and name and which is placed on the side of a vehicle transporting certain hazardous materials.

Common Preservatives:

- Hydrochloric Acid - HCl
- Sulfuric Acid - $H_2SO_4$
- Nitric Acid - $HNO_3$
- Sodium Hydroxide - NaOH

Other Preservatives

- Zinc Acetate
- Sodium Thiosulfate - $Na_2S_2O_3$

Normality (N) - Concentration of a solution expressed as equivalent per liter, an equivalent being the amount of a substance containing 1 gram-atom of replaceable hydrogen or its equivalent.

Reportable Quantity (RQ) - For the purposes of this SOP, means the quantity specified in column 3 of the Appendix to DOT 49 CFR §172.101 for any material identified in column 1 of the appendix. A spill greater than the amount specified must be reported to the National Response Center.

Sample - A sample is physical evidence collected from a facility or the environment, which is representative of conditions at the location and time of collection.

## 4.0 RESPONSIBILITIES

Field Operations Leader - Directly responsible for the bottling, preservation, labeling, packaging, shipping, and custody of samples up to and including release to the shipper.

Field Samplers - Responsible for initiating the Chain-of-Custody Record (per SOP SA-6.3), implementing the packaging and shipping requirements, and maintaining custody of samples until they are relinquished to another custodian or to the shipper.

## 5.0 PROCEDURES

Sample identification, labeling, documentation, and chain-of-custody are addressed by SOP SA-6.3.

### 5.1 Sample Containers

Different types of chemicals react differently with sample containers made of various materials. For example, trace metals adsorb more strongly to glass than to plastic, whereas many organic chemicals may dissolve various types of plastic containers. Attachments A and B show proper containers (as well as other information) per 40 CFR 136. In general, the sample container shall allow approximately 5-10 percent air space ("ullage") to allow for expansion/vaporization if the sample warms during transport. However, for collection of volatile organic compounds, head space shall be omitted. The analytical laboratory will generally provide certified-clean containers for samples to be analyzed for chemical constituents. Shelby tubes or other sample containers are generally provided by the driller for samples requiring geotechnical analysis. Sufficient lead time shall be allowed for a delivery of sample container orders. Therefore, it is critical to use the correct container to maintain the integrity of the sample prior to analysis.

Once opened, the container must be used at once for storage of a particular sample. Unused but opened containers are to be considered contaminated and must be discarded. Because of the potential for introduction of contamination, they cannot be reclosed and saved for later use. Likewise, any unused containers which appear contaminated upon receipt, or which are found to have loose caps or a missing Teflon liner (if required for the container), shall be discarded.

### 5.2 Sample Preservation

Many water and soil samples are unstable and therefore require preservation to prevent changes in either the concentration or the physical condition of the constituent(s) requiring analysis. Although complete and irreversible preservation of samples is not possible, preservation does retard the chemical and biological changes that inevitably take place after the sample is collected. Preservation techniques are usually limited to pH control, chemical addition(s), and refrigeration/ freezing (certain biological samples only).

### 5.2.1 Overview

The preservation techniques to be used for various analytes are listed in Attachments A and B. Reagents required for sample preservation will either be added to the sample containers by the laboratory prior to their shipment to the field or be added in the field (in a clean environment). Only high purity reagents shall be used for preservation. In general, aqueous samples of low-concentration organics (or soil samples of low- or medium-concentration organics) are cooled to 4°C. Medium-concentration aqueous samples, high-hazard organic samples, and some gas samples are typically not preserved. Low-concentration aqueous samples for metals are acidified with $HNO_3$, whereas medium-concentration and high-hazard aqueous metal samples are not preserved. Low- or medium-concentration soil samples for metals are cooled to 4°C, whereas high-hazard samples are not cooled.

The following subsections describe the procedures for preparing and adding chemical preservatives. Attachments A and B indicate the specific analytes which require these preservatives.

The FOL is responsible for ensuring that an accurate Chemical Inventory is created and maintained for all hazardous chemicals brought to the work site (see Section 5 of the TtNUS Health and Safety Guidance Manual). Furthermore, the FOL must ensure that a corresponding Material Safety Data Sheet (MSDS) is collected for every substance entered on the site Chemical Inventory, and that all persons using/handling/ disposing of these substances review the appropriate MSDS for substances they will work with. The Chemical Inventory and the MSDSs must be maintained at each work site in a location and manner where they are readily-accessible to all personnel.

### 5.2.2 Preparation and Addition of Reagents

Addition of the following acids or bases may be specified for sample preservation; these reagents shall be analytical reagent (AR) grade or purer and shall be diluted to the required concentration with deionized water before field sampling commences. To avoid uncontrolled reactions, be sure to Add Acid to water (not vice versa). A dilutions guide is provided below.

| Acid/Base | Dilution | Concentration | Estimated Amount Required for Preservation |
| --- | --- | --- | --- |
| Hydrochloric Acid (HCl) | 1 part concentrated HCl: 1 part double-distilled, deionized water | 6N | 5-10 mL |
| Sulfuric Acid ($H_2SO_4$) | 1 part concentrated $H_2SO_4$: 1 part double-distilled, deionized water | 18N | 2 - 5 mL |
| Nitric Acid ($HNO_3$) | Undiluted concentrated $HNO_3$ | 16N | 2 - 5 mL |
| Sodium Hydroxide (NaOH) | 400 grams solid NaOH dissolved in 870 mL double-distilled, deionized water; yields 1 liter of solution | 10N | 2 mL |

The amounts required for preservation shown in the above table assumes proper preparation of the preservative and addition of the preservative to one liter of aqueous sample. This assumes that the sample is initially at pH 7, is poorly buffered, and does not contain particulate matter; as these conditions vary, more preservative may be required. Consequently, the final sample pH must be checked using narrow-range pH paper, as described in the generalized procedure detailed below:

- Pour off 5-10 mL of sample into a dedicated, clean container. Use some of this sample to check the initial sample pH using wide range (0-14) pH paper. Never dip the pH paper into the sample; always apply a drop of sample to the pH paper using a clean stirring rod or pipette.
- Add about one-half of the estimated preservative required to the original sample bottle. Cap and invert gently several times to mix. Check pH (as described above) using medium range pH paper (pH 0-6 or pH 7.5-14, as applicable).
- Cap sample bottle and seal securely.

Additional considerations are discussed below:

- To test if ascorbic acid must be used to remove oxidizing agents present in the sample before it can be properly preserved, place a drop of sample on KI-starch paper. A blue color indicates the need for ascorbic acid addition.

  If required, add a few crystals of ascorbic acid to the sample and retest with the KI-starch paper. Repeat until a drop of sample produces no color on the KI-starch paper. Then add an additional 0.6 grams of ascorbic acid per each liter of sample volume.

  Continue with proper base preservation of the sample as described above.

- Samples for sulfide analysis must be treated by the addition of 4 drops (0.2 mL) of 2N zinc acetate solution per 100 ml of sample.

  The 2N zinc acetate solution is made by dissolving 220 grams of zinc acetate in 870 mL of double-distilled, deionized water to make 1 liter of solution.

  The sample pH is then raised to 9 using the NaOH preservative.

- Sodium thiosulfate must be added to remove residual chlorine from a sample. To test the sample for residual chlorine use a field test kit specially made for this purpose.

  If residual chlorine is present, add 0.08 grams of sodium thiosulfate per liter of sample to remove the residual chlorine.

  Continue with proper acidification of the sample as described above.

For biological samples, 10% buffered formalin or isopropanol may also be required for preservation. Questions regarding preservation requirements should be resolved through communication with the laboratory <u>before</u> sampling begins.

**5.3 <u>Field Filtration</u>**

At times, field-filtration may be required to provide for the analysis of dissolved chemical constituents. Field-filtration must be performed <u>prior to</u> the preservation of samples as described above. General procedures for field filtration are described below:

- The sample shall be filtered through a non-metallic, 0.45-micron membrane filter, immediately after collection. The filtration system shall consist of dedicated filter canister, dedicated tubing, and a peristaltic pump with pressure or vacuum pumping squeeze action (since the sample is filtered by mechanical peristalsis, the sample travels only through the tubing).

- To perform filtration, thread the tubing through the peristaltic pump head. Attach the filter canister to the discharge end of the silicon tubing (note flow direction arrow); attach the aqueous sample container to the intake end of the silicon tubing. Turn the peristaltic pump on and perform filtration. Run approximately 100 ml of sample through the filter and discard prior to sample collection.

- Continue by preserving the filtrate (contained in the filter canister), as applicable and generally described above.

## 5.4 Sample Packaging and Shipping

Only employees who have successfully completed the TtNUS "Shipping Hazardous Materials" training course are authorized to package and ship hazardous substances. These trained individuals are responsible for performing shipping duties in accordance with this training.

Samples collected for shipment from a site shall be classified as either environmental or hazardous material samples. Samples from drums containing materials other than Investigative Derived Waste (IDW) and samples obtained from waste piles or bulk storage tanks are generally shipped as hazardous materials. A distinction must be made between the two types of samples in order to:

- Determine appropriate procedures for transportation of samples (if there is any doubt, a sample shall be considered hazardous and shipped accordingly.)

- Protect the health and safety of transport and laboratory personnel receiving the samples (special precautions are used by the shipper and at laboratories when hazardous materials are received.)

Detailed procedures for packaging environmental samples are outlined in the remainder of this section.

### 5.4.1 Environmental Samples

Environmental samples are packaged as follows:

- Place properly identified sample container, with lid securely fastened, in a plastic bag (e.g. Ziploc baggie), and seal the bag.

- Place sample in a cooler constructed of sturdy material which has been lined with a large, plastic bag (e.g. "garbage" bag). Drain plugs on coolers must be taped shut.

- Pack with enough cushioning materials such as bubble wrap (shoulders of bottles must be iced if required) to minimize the possibility of the container breaking.

- If cooling is required (see Attachments A and B), place ice around sample container shoulders, and on top of packing material (minimum of 8 pounds of ice for a medium-size cooler).

- Seal (i.e., tape or tie top in knot) large liner bag.

- The original (top, signed copy) of the COC form shall be placed inside a large Ziploc-type bag and taped inside the lid of the shipping cooler. If multiple coolers are sent but are included on one COC form, the COC form should be sent with the cooler containing the vials for VOC analysis. The COC form should then state how many coolers are included with that shipment.

- Close and seal outside of cooler as described in SOP SA-6.3. Signed custody seals must be used.

Coolers must be marked as containing "Environmental Samples." The appropriate side of the container must be marked "This End Up" and arrows placed appropriately. No DOT marking or labeling is required; there are no DOT restrictions on mode of transportation.

## 6.0 REFERENCES

American Public Health Association, 1981. Standard Methods for the Examination of Water and Wastewater, 15th Edition. APHA, Washington, D.C.

International Air Transport Association (latest issue). Dangerous Goods Regulations, Montreal, Quebec, Canada.

U.S. Department of Transportation (latest issue). Hazardous Materials Regulations, 49 CFR 171-177.

U.S. EPA, 1984. "Guidelines Establishing Test Procedures for the Analysis of Pollutants under Clean Water Act." Federal Register, Volume 49 (209), October 26, 1984, p. 43234.

U.S. EPA, 1979. Methods for Chemical Analysis of Water and Wastes. EPA-600/4-79-020, U.S. EPA-EMSL, Cincinnati, Ohio.

## ATTACHMENT A

## GENERAL SAMPLE CONTAINER AND PRESERVATION REQUIREMENTS

| Sample Type and Concentration | | | Container[1] | Sample Size | Preservation[2] | Holding Time[2] |
|---|---|---|---|---|---|---|
| **WATER** | | | | | | |
| Organics (GC&GC/MS) | VOC | Low | Borosilicate glass | 2 x 40 mL | Cool to 4°C<br>HCl to ≤ 2 | 14 days[9] |
| | Extractables SVOCs and pesticide/PCBs) | (Low | Amber glass | 2x2 L or 4x1 L | Cool to 4°C | 7 days to extraction; 40 days after extraction |
| | Extractables SVOCs and pesticide/PCBs) | (Medium | Amber glass | 2x2 L or 4x1 L | None | 7 days to extraction; 40 days after extraction |
| Inorganics | Metals | Low | High-density polyethylene | 1 L | $HNO_3$ to pH ≤2 | 6 months (Hg-28 days) |
| | | Medium | Wide-mouth glass | 16 oz. | None | 6 months |
| | Cyanide | Low | High-density polyethylene | 1 L | NaOH to pH>12 | 14 days |
| | Cyanide | Medium | Wide-mouth glass | 16 oz. | None | 14 days |
| Organic/ Inorganic | High Hazard | | Wide-mouth glass | 8 oz. | None | 14 days |
| **SOIL** | | | | | | |
| Organics (GC&GC/MS) | VOC | | EnCore Sampler | (3) 5 g Samplers | Cool to 4°C | 48 hours to lab preservation |
| | Extractables SVOCs and pesticides/PCBs) | (Low | Wide-mouth glass | 8 oz. | Cool to 4°C | 14 days to extraction; 40 days after extraction |
| | Extractables SVOCs and pesticides/PCBs) | (Medium | Wide-mouth glass | 8 oz. | Cool to 4°C | 14 days to extraction; 40 days after extraction |
| Inorganics | Low/Medium | | Wide-mouth glass | 8 oz. | Cool to 4°C | 6 months<br>(Hg - 28 days)<br>Cyanide (14 days) |
| Organic/Inorganic | High Hazard | | Wide-mouth glass | 8 oz. | None | NA |
| Dioxin/Furan | All | | Wide-mouth glass | 4 oz. | None | 35 days until extraction;<br>40 days after extraction |
| TCLP | All | | Wide-mouth glass | 8 oz. | None | 7 days until preparation; analysis as per fraction |
| **AIR** | | | | | | |
| Volatile Organics | Low/Medium | | Charcoal tube -- 7 cm long, 6 mm OD, 4 mm ID | 100 L air | Cool to 4°C | 5 days recommended |

1 All glass containers should have Teflon cap liners or septa.
2 See Attachment E. Preservation and maximum holding time allowances per 40 CFR 136.

## ATTACHMENT B

## ADDITIONAL REQUIRED CONTAINERS, PRESERVATION TECHNIQUES, AND HOLDING TIMES

| Parameter Number/Name | Container(1) | Preservation(2)(3) | Maximum Holding Time(4) |
| --- | --- | --- | --- |
| **INORGANIC TESTS:** | | | |
| Acidity | P, G | Cool, 4°C | 14 days |
| Alkalinity | P, G | Cool, 4°C | 14 days |
| Ammonia - Nitrogen | P, G | Cool, 4°C; $H_2SO_4$ to pH 2 | 28 days |
| Biochemical Oxygen Demand (BOD) | P, G | Cool, 4°C | 48 hours |
| Bromide | P, G | None required | 28 days |
| Chemical Oxygen Demand (COD) | P, G | Cool, 4°C; $H_2SO_4$ to pH 2 | 28 days |
| Chloride | P, G | None required | 28 days |
| Chlorine, Total Residual | P, G | None required | Analyze immediately |
| Color | P, G | Cool, 4°C | 48 hours |
| Cyanide, Total and Amenable to Chlorination | P, G | Cool, 4°C; NaOH to pH 12; 0.6 g ascorbic acid(5) | 14 days(6) |
| Fluoride | P | None required | 28 days |
| Hardness | P, G | $HNO_3$ to pH 2; $H_2SO_4$ to pH 2 | 6 months |
| Total Kjeldahl and Organic Nitrogen | P, G | Cool, 4°C; $H_2SO_4$ to pH 2 | 28 days |
| Nitrate - Nitrogen | P, G | None required | 48 hours |
| Nitrate-Nitrite - Nitrogen | P, G | Cool, 4°C; $H_2SO_4$ to pH 2 | 28 days |
| Nitrite - Nitrogen | P, G | Cool, 4°C | 48 hours |
| Oil & Grease | G | Cool, 4°C; $H_2SO_4$ to pH 2 | 28 days |
| Total Organic Carbon (TOC) | P, G | Cool, 4°C; HCl or $H_2SO_4$ to pH 2 | 28 days |
| Orthophosphate | P, G | Filter immediately; Cool, 4°C | 48 hours |
| Oxygen, Dissolved-Probe | G Bottle & top | None required | Analyze immediately |
| Oxygen, Dissolved-Winkler | G Bottle & top | Fix on site and store in dark | 8 hours |
| Phenols | G | Cool, 4°C; $H_2SO_4$ to pH 2 | 28 days |
| Phosphorus, Total | P, G | Cool, 4°C; $H_2SO_4$ to pH 2 | 28 days |
| Residue, Total | P, G | Cool, 4°C | 7 days |
| Residue, Filterable (TDS) | P, G | Cool, 4°C | 7 days |
| Residue, Nonfilterable (TSS) | P, G | Cool, 4°C | 7 days |
| Residue, Settleable | P, G | Cool, 4°C | 48 hours |
| Residue, Volatile (Ash Content) | P, G | Cool, 4°C | 7 days |
| Silica | P | Cool, 4°C | 28 days |
| Specific Conductance | P, G | Cool, 4°C | 28 days |
| Sulfate | P, G | Cool, 4°C | 28 days |

**ATTACHMENT B**
**ADDITIONAL REQUIRED CONTAINERS, PRESERVATION TECHNIQUES, AND HOLDING TIMES**
**PAGE TWO**

| Parameter Number/Name | Container(1) | Preservation(2)(3) | Maximum Holding Time(4) |
|---|---|---|---|
| **INORGANIC TESTS (Cont'd):** | | | |
| Sulfide | P, G | Cool, 4°C; add zinc acetate plus sodium hydroxide to pH 9 | 7 days |
| Sulfite | P, G | None required | Analyze immediately |
| Turbidity | P, G | Cool, 4°C | 48 hours |
| **METALS:(7)** | | | |
| Chromium VI (Hexachrome) | P, G | Cool, 4°C | 24 hours |
| Mercury (Hg) | P, G | $HNO_3$ to pH 2 | 28 days |
| Metals, except Chromium VI and Mercury | P, G | $HNO_3$ to pH 2 | 6 months |
| **ORGANIC TESTS:(8)** | | | |
| Purgeable Halocarbons | G, Teflon-lined septum | Cool, 4°C; 0.008% $Na_2S_2O_3$(5) | 14 days |
| Purgeable Aromatic Hydrocarbons | G, Teflon-lined septum | Cool, 4°C; 0.008% $Na_2S_2O_3$(5) HCl to pH 2 (9) | 14 days |
| Acrolein and Acrylonitrile | G, Teflon-lined septum | Cool, 4°C; 0.008% $Na_2S_2O_3$(5) adjust pH to 4-5 (10) | 14 days |
| Phenols(11) | G, Teflon-lined cap | Cool, 4°C; 0.008% $Na_2S_2O_3$(5) | 7 days until extraction; 40 days after extraction |
| Benzidines(11),(12) | G, Teflon-lined cap | Cool, 4°C; 0.008% $Na_2S_2O_3$(5) | 7 days until extraction(13) |
| Phthalate esters(11) | G, Teflon-lined cap | Cool, 4°C | 7 days until extraction; 40 days after extraction |
| Nitrosamines(11),(14) | G, Teflon-lined cap | Cool, 4°C; store in dark; 0.008% $Na_2S_2O_3$(5) | 7 days until extraction; 40 days after extraction |
| PCBs(11) | G, Teflon-lined cap | Cool, 4°C | 7 days until extraction; 40 days after extraction |
| Nitroaromatics & Isophorone(11) | G, Teflon-lined cap | Cool, 4°C; 0.008% $Na_2S_2O_3$(5); store in dark | 7 days until extraction; 40 days after extraction |
| Polynuclear Aromatic Hydrocarbons (PAHs)(11),(14) | G, Teflon-lined cap | Cool, 4°C; 0.008% $Na_2S_2O_3$(5); store in dark | 7 days until extraction; 40 days after extraction |
| Haloethers(11) | G, Teflon-lined cap | Cool, 4°C; 0.008% $Na_2S_2O_3$(5) | 7 days until extraction; 40 days after extraction |
| Dioxin/Furan (TCDD/TCDF)(11) | G, Teflon-lined cap | Cool, 4°C; 0.008% $Na_2S_2O_3$(5) | 7 days until extraction; 40 days after extraction |

**ATTACHMENT B**
**ADDITIONAL REQUIRED CONTAINERS, PRESERVATION TECHNIQUES, AND HOLDING TIMES**
**PAGE THREE**

(1) Polyethylene (P): generally 500 ml or Glass (G): generally 1L.

(2) Sample preservation should be performed immediately upon sample collection. For composite chemical samples each aliquot should be preserved at the time of collection. When use of an automated sampler makes it impossible to preserve each aliquot, then chemical samples may be preserved by maintaining at 4°C until compositing and sample splitting is completed.

(3) When any sample is to be shipped by common carrier or sent through the United States Mail, it must comply with the Department of Transportation Hazardous Materials Regulations (49 CFR Part 172).

(4) Samples should be analyzed as soon as possible after collection. The times listed are the maximum times that samples may be held before analysis and still be considered valid. Samples may be held for longer periods only if the permittee, or monitoring laboratory, has data on file to show that the specific types of samples under study are stable for the longer periods, and has received a variance from the Regional Administrator.

(5) Should only be used in the presence of residual chlorine.

(6) Maximum holding time is 24 hours when sulfide is present. Optionally, all samples may be tested with lead acetate paper before pH adjustments are made to determine if sulfide is present. If sulfide is present, it can be removed by the addition of cadmium nitrate powder until a negative spot test is obtained. The sample is filtered and then NaOH is added to pH 12.

(7) Samples should be filtered immediately on site before adding preservative for dissolved metals.

(8) Guidance applies to samples to be analyzed by GC, LC, or GC/MS for specific compounds.

(9) Sample receiving no pH adjustment must be analyzed within 7 days of sampling.

(10) The pH adjustment is not required if acrolein will not be measured. Samples for acrolein receiving no pH adjustment must be analyzed within 3 days of sampling.

(11) When the extractable analytes of concern fall within a single chemical category, the specified preservative and maximum holding times should be observed for optimum safeguard of sample integrity. When the analytes of concern fall within two or more chemical categories, the sample may be preserved by cooling to 4°C, reducing residual chlorine with 0.008% sodium thiosulfate, storing in the dark, and adjusting the pH to 6-9; samples preserved in this manner may be held for 7 days before extraction and for 40 days after extraction. Exceptions to this optional preservation and holding time procedure are noted in footnote 5 (re: the requirement for thiosulfate reduction of residual chlorine) and footnotes 12, 13 (re: the analysis of benzidine).

(12) If 1,2-diphenylthydrazine is likely to be present, adjust the pH of the sample to 4.0±0.2 to prevent rearrangement to benzidine.

(13) Extracts may be stored up to 7 days before analysis if storage is conducted under an inert (oxidant-free) atmosphere.

(14) For the analysis of diphenylnitrosamine, add 0.008% $Na_2S_2O_3$ and adjust pH to 7-10 with NaOH within 24 hours of sampling.

(15) The pH adjustment may be performed upon receipt at the laboratory and may be omitted if the samples are extracted within 72 hours of collection. For the analysis of aldrin, add 0.008% $Na_2S_2O_3$.

## TABLE OF CONTENTS

**SECTION** **PAGE**

## 1.0 PURPOSE

The purpose of this Standard Operating Procedure (SOP) is to identify and designate the field data record forms, logs and reports generally initiated and maintained for documenting Tetra Tech NUS field activities.

## 2.0 SCOPE

Documents presented within this procedure (or equivalents) shall be used for all Tetra Tech NUS field activities, as applicable. Other or additional documents may be required by specific client contracts or project planning documents.

## 3.0 GLOSSARY

None

## 4.0 RESPONSIBILITIES

Project Manager (PM) - The Project Manager is responsible for obtaining hardbound, controlled-distribution logbooks (from the appropriate source), as needed. In addition, the Project Manager is responsible for placing all field documentation used in site activities (i.e., records, field reports, sample data sheets, field notebooks, and the site logbook) in the project's central file upon the completion of field work.

Field Operations Leader (FOL) - The Field Operations Leader is responsible for ensuring that the site logbook, notebooks, and all appropriate and current forms and field reports illustrated in this guideline (and any additional forms required by the contract) are correctly used, accurately filled out, and completed in the required time-frame.

## 5.0 PROCEDURES

### 5.1 Site Logbook

#### 5.1.1 General

The site logbook is a hard-bound, paginated, controlled-distribution record book in which all major onsite activities are documented. At a minimum, the following activities/events shall be recorded or referenced (daily) in the site logbook:

- All field personnel present
- Arrival/departure of site visitors
- Time and date of H&S training
- Arrival/departure of equipment
- Time and date of equipment calibration
- Start and/or completion of borehole, trench, monitoring well installation, etc.
- Daily onsite activities performed each day
- Sample pickup information
- Health and Safety issues (level of protection observed, etc.)
- Weather conditions

A site logbook shall be maintained for each project. The site logbook shall be initiated at the start of the first onsite activity (e.g., site visit or initial reconnaissance survey). Entries are to be made for every day that onsite activities take place which involve Tetra Tech NUS or subcontractor personnel. Upon completion of the fieldwork, the site logbook must become part of the project's central file.

The following information must be recorded on the cover of each site logbook:

- Project name
- Tetra Tech NUS project number
- Sequential book number
- Start date
- End date

Information recorded daily in the site logbook need not be duplicated in other field notebooks (see Section 5.2), but must summarize the contents of these other notebooks and refer to specific page locations in these notebooks for detailed information (where applicable). An example of a typical site logbook entry is shown in Attachment A.

If measurements are made at any location, the measurements and equipment used must either be recorded in the site logbook or reference must be made to the field notebook in which the measurements are recorded (see Attachment A).

All logbook, notebook, and log sheet entries shall be made in indelible ink (black pen is preferred). No erasures are permitted. If an incorrect entry is made, the entry shall be crossed out with a single strike mark, and initialed and dated. At the completion of entries by any individual, the logbook pages used must be signed and dated. The site logbook must also be signed by the Field Operations Leader at the end of each day.

### 5.1.2 Photographs

When movies, slides, or photographs are taken of a site or any monitoring location, they must be numbered sequentially to correspond to logbook/notebook entries. The name of the photographer, date, time, site location, site description, and weather conditions must be entered in the logbook/notebook as the photographs are taken. A series entry may be used for rapid-sequence photographs. The photographer is not required to record the aperture settings and shutter speeds for photographs taken within the normal automatic exposure range. However, special lenses, films, filters, and other image-enhancement techniques must be noted in the logbook/notebook. If possible, such techniques shall be avoided, since they can adversely affect the accuracy of photographs. Chain-of-custody procedures depend upon the subject matter, type of camera (digital or film), and the processing it requires. Film used for aerial photography, confidential information, or criminal investigation require chain-of-custody procedures. Once processed, the slides of photographic prints shall be consecutively numbered and labeled according to the logbook/notebook descriptions. The site photographs and associated negatives and/or digitally saved images to compact disks must be docketed into the project's central file.

## 5.2 <u>Field Notebooks</u>

Key field team personnel may maintain a separate dedicated field notebook to document the pertinent field activities conducted directly under their supervision. For example, on large projects with multiple investigative sites and varying operating conditions, the Health and Safety Officer may elect to maintain a separate field notebook. Where several drill rigs are in operation simultaneously, each site geologist assigned to oversee a rig must maintain a field notebook.

## 5.3 **Field Forms**

All Tetra Tech NUS field forms (see list in Section 6.0 of this SOP) can be found on the company's intranet site (http://intranet.ttnus.com) under Field Log Sheets. Forms may be altered or revised for project-specific needs contingent upon client approval. Care must be taken to ensure that all essential information can be documented. Guidelines for completing these forms can be found in the related sampling SOP.

### 5.3.1 Sample Collection, Labeling, Shipment, Request for Analysis, and Field Test Results

#### 5.3.1.1 Sample Log Sheet

Sample Log Sheets are used to record specified types of data while sampling. The data recorded on these sheets are useful in describing the sample as well as pointing out any problems, difficulties, or irregularities encountered during sampling. A log sheet must be completed for each sample obtained, including field quality control (QC) samples.

#### 5.3.1.2 Sample Label

A typical sample label is illustrated in Attachment B. Adhesive labels must be completed and applied to every sample container. Sample labels can usually be obtained from the appropriate Program source electronically generated in-house, or are supplied from the laboratory subcontractor.

#### 5.3.1.3 Chain-of-Custody Record Form

The Chain-of-Custody (COC) Record is a multi-part form that is initiated as samples are acquired and accompanies a sample (or group of samples) as they are transferred from person to person. This form must be used for any samples collected for chemical or geotechnical analysis whether the analyses are performed on site or off site. One carbonless copy of the completed COC form is retained by the field crew, one copy is sent to the Project Manager (or designee), while the original is sent to the laboratory. The original (top, signed copy) of the COC form shall be placed inside a large Ziploc-type bag and taped inside the lid of the shipping cooler. If multiple coolers are sent but are included on one COC form, the COC form should be sent with the cooler containing vials for VOC analysis or the cooler with the air bill attached. The air bill should then state how many coolers are included with that shipment. An example of a Chain-of-Custody Record form is provided as Attachment C. Once the samples are received at the laboratory, the sample cooler and contents are checked and any problems are noted on the enclosed COC form (any discrepancies between the sample labels and COC form and any other problems that are noted are resolved through communication between the laboratory point-of-contact and the Tetra Tech NUS Project Manager). The COC form is signed and copied. The laboratory will retain the copy while the original becomes part of the samples' corresponding analytical data package.

#### 5.3.1.4 Chain-of-Custody Seal

Attachment D is an example of a custody seal. The Custody seal is an adhesive-backed label. It is part of a chain-of-custody process and is used to prevent tampering with samples after they have been collected in the field and sealed in coolers for transport to the laboratory. The COC seals are signed and dated by the sampler(s) and affixed across the lid and body of each cooler (front and back) containing environmental samples (see SOP SA-6.1). COC seals may be available from the laboratory; these seals may also be purchased from a supplier.

5.3.1.5 Geochemical Parameters Log Sheets

Field Analytical Log Sheets are used to record geochemical and/or natural attenuation field test results.

**5.3.2 Hydrogeological and Geotechnical Forms**

5.3.2.1 Groundwater Level Measurement Sheet

A Groundwater Level Measurement Sheet must be filled out for each round of water level measurements made at a site.

5.3.2.2 Data Sheet for Pumping Test

During the performance of a pumping test (or an in-situ hydraulic conductivity test), a large amount of data must be recorded, often within a short time period. The Pumping Test Data Sheet facilitates this task by standardizing the data collection format for the pumping well and observation wells, and allowing the time interval for collection to be laid out in advance.

5.3.2.3 Packer Test Report Form

A Packer Test Report Form must be completed for each well upon which a packer test is conducted.

5.3.2.4 Boring Log

During the progress of each boring, a log of the materials encountered, operation and driving of casing, and location of samples must be kept. The Summary Log of Boring, or Boring Log is used for this purpose and must be completed for each soil boring performed. In addition, if volatile organics are monitored on cores, samples, cuttings from the borehole, or breathing zone, (using a PID or FID), these readings must be entered on the boring log at the appropriate depth. The "Remarks" column can be used to subsequently enter the laboratory sample number, the concentration of key analytical results, or other pertinent information. This feature allows direct comparison of contaminant concentrations with soil characteristics.

5.3.2.5 Monitoring Well Construction Details Form

A Monitoring Well Construction Details Form must be completed for every monitoring well, piezometer, or temporary well point installed. This form contains specific information on length and type of well riser pipe and screen, backfill, filter pack, annular seal and grout characteristics, and surface seal characteristics. This information is important in evaluating the performance of the monitoring well, particularly in areas where water levels show temporal variation, or where there are multiple (immiscible) phases of contaminants. Depending on the type of monitoring well (in overburden or bedrock, stick-up or flush mount), different forms are used.

5.3.2.6 Test Pit Log

When a test pit or trench is constructed for investigative or sampling purposes, a Test Pit Log must be filled out by the responsible field geologist or sampling technician.

5.3.2.7 Miscellaneous Monitoring Well Forms

Monitoring Well Materials Certificate of Conformance should be used as the project directs to document all materials utilized during each monitoring well installation.

The Monitoring Well Development Record should be used as the project directs to document all well development activities.

5.3.2.8 Miscellaneous Field Forms - QA and Checklists

Container Sample and Inspection Sheet should be used as the project directs each time a container (drum, tank, etc.) is sampled and/or inspected.

QA Sample Log Sheet should be used at the project directs each time a QA sample is colleted, such as Rinsate Blank, Source Blank, etc.

Field Task Modification Request (FTMR) will be prepared for all deviations from the project planning documents. The FOL is responsible for initiating the FTMRs. Copies of all FTMRs will be maintained with the onsite planning documents and originals will be placed in the final evidence file.

The Field Project Daily Activities Check List and Field Project Pre-Mobilization Checklist should be used during both the planning and field effort to assure that all necessary tasks are planned for and completed. These two forms are not a requirement but a useful tool for most field work.

### 5.3.3 Equipment Calibration and Maintenance Form

The calibration or standardization of monitoring, measuring or test equipment is necessary to assure the proper operation and response of the equipment, to document the accuracy, precision or sensitivity of the measurement, and determine if correction should be applied to the readings. Some items of equipment require frequent calibration, others infrequent. Some are calibrated by the manufacturer, others by the user.

Each instrument requiring calibration has its own Equipment Calibration Log which documents that the manufacturer's instructions were followed for calibration of the equipment, including frequency and type of standard or calibration device. An Equipment Calibration Log must be maintained for each electronic measuring device used in the field; entries must be made for each day the equipment is used or in accordance with the manufacturer's recommendations.

## 5.4 Field Reports

The primary means of recording onsite activities is the site logbook. Other field notebooks may also be maintained. These logbooks and notebooks (and supporting forms) contain detailed information required for data interpretation or documentation, but are not easily useful for tracking and reporting of progress. Furthermore, the field logbook/notebooks remain onsite for extended periods of time and are thus not accessible for timely review by project management.

### 5.4.1 Daily Activities Report

To provide timely oversight of onsite contractors, Daily Activities Reports are completed and submitted as described below.

5.4.1.1 Description

The Daily Activities Report (DAR) documents the activities and progress for each day's field work. This report must be filled out on a daily basis whenever there are drilling, test pitting, well construction, or other related activities occurring which involve subcontractor personnel. These sheets summarize the work performed and form the basis of payment to subcontractors. The DAR form can be found on the TtNUS intranet site.

5.4.1.2 Responsibilities

It is the responsibility of the rig geologist to complete the DAR and obtain the driller's signature acknowledging that the times and quantities of material entered are correct.

5.4.1.3 Submittal and Approval

At the end of the shift, the rig geologist must submit the Daily Activities Report to the Field Operations Leader (FOL) for review and filing. The Daily Activities Report is not a formal report and thus requires no further approval. The DAR reports are retained by the FOL for use in preparing the site logbook and in preparing weekly status reports for submission to the Project Manager.

### 5.4.2 Weekly Status Reports

To facilitate timely review by project management, photocopies of logbook/notebook entries may be made for internal use.

It should be noted that in addition to summaries described herein, other summary reports may also be contractually required.

All Tetra Tech NUS field forms can be found on the company's intranet site at http://intranet.ttnus.com under Field Log Sheets.

## 6.0 LISTING OF TETRA TECH NUS FIELD FORMS FOUND ON THE TTNUS INTRANET SITE. HTTP://INTRANET.TTNUS.COM CLICK ON FIELD LOG SHEETS

Groundwater Sample Log Sheet
Surface Water Sample Log Sheet
Soil/Sediment Sample Log Sheet
Container Sample and Inspection Sheet
Geochemical Parameters (Natural Attenuation)
Groundwater Level Measurement Sheet
Pumping Test Data Sheet
Packer Test Report Form
Boring Log
Monitoring Well Construction Bedrock Flush Mount
Monitoring Well Construction Bedrock Open Hole
Monitoring Well Construction Bedrock Stick Up
Monitoring Well Construction Confining Layer
Monitoring Well Construction Overburden Flush Mount
Monitoring Well Construction Overburden Stick Up
Test Pit Log
Monitoring Well Materials Certificate of Conformance
Monitoring Well Development Record

Daily Activities Record
Field Task Modification Request
Hydraulic Conductivity Test Data Sheet
Low Flow Purge Data Sheet
QA Sample Log Sheet
Equipment Calibration Log
Field Project Daily Activities Checklist
Field Project Pre-Mobilization Checklist

## ATTACHMENT A
## TYPICAL SITE LOGBOOK ENTRY

START TIME: ______________________ DATE: ______________________

SITE LEADER: ______________________
PERSONNEL:

| TtNUS | DRILLER | SITE VISITORS |
|---|---|---|
| ____________ | ____________ | ____________ |
| ____________ | ____________ | ____________ |
| ____________ | ____________ | ____________ |

WEATHER: Clear, 68°F, 2-5 mph wind from SE

ACTIVITIES:

1. Steam jenney and fire hoses were set up.
2. Drilling activities at well ____ resumes. Rig geologist was ______________. See Geologist's Notebook, No. 1, page 29-30, for details of drilling activity. Sample No. 123-21-S4 collected; see sample logbook, page 42. Drilling activities completed at 11:50 and a 4-inch stainless steel well installed. See Geologist's Notebook, No. 1, page 31, and well construction details for well ______.
3. Drilling rig No. 2 steam-cleaned at decontamination pit. Then set up at location of well _______.
4. Well ______ drilled. Rig geologist was ___________________. See Geologist's Notebook, No. 2, page ____ for details of drilling activities. Sample numbers 123-22-S1, 123-22-S2, and 123-22-S3 collected; see sample logbook, pages 43, 44, and 45.
5. Well _____ was developed. Seven 55-gallon drums were filled in the flushing stage. The well was then pumped using the pitcher pump for 1 hour. At the end of the hour, water pumped from well was "sand free."
6. EPA remedial project manger arrives on site at 14:25 hours.
7. Large dump truck arrives at 14:45 and is steam-cleaned. Backhoe and dump truck set up over test pit _________.
8. Test pit _______ dug with cuttings placed in dump truck. Rig geologist was ______________. See Geologist's Notebook, No. 1, page 32, for details of test pit activities. Test pit subsequently filled. No samples taken for chemical analysis. Due to shallow groundwater table, filling in of test pit ___ resulted in a very soft and wet area. A mound was developed and the area roped off.
9. Express carrier picked up samples (see Sample Logbook, pages 42 through 45) at 17:50 hours. Site activities terminated at 18:22 hours. All personnel off site, gate locked.

______________________________________

Field Operations Leader

## ATTACHMENT B

| | | |
|---|---|---|
| Tetra Tech NUS, Inc.<br>661 Andersen Drive<br>Pittsburgh, 15220<br>(412)921-7090 | **Project:**<br>**Site:**<br>**Location:** | |
| **Sample No:** | | **Matrix:** |
| **Date:** | **Time:** | **Preserve:** |
| **Analysis:** | | |
| **Sampled by:** | | **Laboratory:** |

## ATTACHMENT C

TETRA TECH NUS, INC.

**CHAIN OF CUSTODY** | NUMBER 3413 | PAGE ____ OF ____

| PROJECT NO: | FACILITY: | PROJECT MANAGER | PHONE NUMBER | LABORATORY NAME AND CONTACT: |
|---|---|---|---|---|
| SAMPLERS (SIGNATURE) | | FIELD OPERATIONS LEADER | PHONE NUMBER | ADDRESS |
| | | CARRIER/WAYBILL NUMBER | | CITY, STATE |

STANDARD TAT ☐
RUSH TAT ☐
☐ 24 hr. ☐ 48 hr. ☐ 72 hr. ☐ 7 day ☐ 14 day

CONTAINER TYPE PLASTIC (P) or GLASS (G)

PRESERVATIVE USED

TYPE OF ANALYSIS

| DATE YEAR ____ | TIME | SAMPLE ID | LOCATION ID | TOP DEPTH (FT) | BOTTOM DEPTH (FT) | MATRIX (GW, SO, SW, SD, QC, ETC.) | COLLECTION METHOD GRAB (G) COMP (C) | No. OF CONTAINERS | | | | | | | | | COMMENTS |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | | | | |

| | | | | | |
|---|---|---|---|---|---|
| 1. RELINQUISHED BY | DATE | TIME | 1. RECEIVED BY | DATE | TIME |
| 2. RELINQUISHED BY | DATE | TIME | 2. RECEIVED BY | DATE | TIME |
| 3. RELINQUISHED BY | DATE | TIME | 3. RECEIVED BY | DATE | TIME |
| COMMENTS | | | | | |

DISTRIBUTION: WHITE (ACCOMPANIES SAMPLE) YELLOW (FIELD COPY) PINK (FILE COPY)

4/02R
FORM NO. TtNUS-001

**ATTACHMENT D**

**CHAIN-OF-CUSTODY SEAL**

| | |
|---|---|
| Signature | **CUSTODY SEAL** |
| Date | Date |
| **CUSTODY SEAL** | Signature |

| | | | |
|---|---|---|---|
| TETRA TECH NUS, INC. | **STANDARD OPERATING PROCEDURES** | Number SA-7.1 | Page 1 of 8 |
| | | Effective Date 09/03 | Revision 3 |
| | | Applicability Tetra Tech NUS, Inc. | |
| | | Prepared Earth Sciences Department | |
| Subject DECONTAMINATION OF FIELD EQUIPMENT | | Approved D. Senovich | |

## TABLE OF CONTENTS

**SECTION** **PAGE**

## 1.0 PURPOSE

Decontamination is the process of removing and/or neutralizing site contaminants that have contacted and/or accumulated on equipment. The objective/purpose of this SOP is intended to protect site personnel, general public, and the sample integrity through the prevention of cross contamination onto unaffected persons or areas. It is further intended through this procedure to provide guidelines regarding the appropriate procedures to be followed when decontaminating drilling equipment, monitoring well materials, chemical sampling equipment and field analytical equipment.

## 2.0 SCOPE

This procedure applies to all equipment including drilling equipment, heavy equipment, monitoring well materials, as well as chemical sampling and field analytical equipment decontamination that may be used to provide access/acquire environmental samples. Where technologically and economically feasible, single use sealed disposable equipment will be employed to minimize the potential for cross contamination. This procedure also provides general reference information on the control of contaminated materials.

## 3.0 GLOSSARY

Acid - For decontamination of equipment when sampling for trace levels of inorganics, a 10% solution of nitric acid in deionized water should be used. Due to the leaching ability of nitric acid, it should not be used on stainless steel.

Alconox/Liquinox - A brand of phosphate-free laboratory-grade detergent.

Decontamination Solution - Is a solution selected/identified within the Health and Safety Plan or Project-Specific Quality Assurance Plan. The solution is selected and employed as directed by the project chemist/health and safety professional.

Deionized Water (DI) - Deionized water is tap water that has been treated by passing through a standard deionizing resin column. This water may also pass through additional filtering media to attain various levels of analyte-free status. The DI water should meet CAP and NCCLS specifications for reagent grade, Type I water.

Potable Water - Tap water used from any municipal water treatment system. Use of an untreated potable water supply is not an acceptable substitute for tap water.

Pressure Washing - Employs high pressure pumps and nozzle configuration to create a high pressure spray of potable water. High pressure spray is employed to remove solids.

Solvent - The solvent of choice is pesticide-grade Isopropanol. Use of other solvents (methanol, acetone, pesticide-grade hexane, or petroleum ether) may be required for particular projects or for a particular purpose (e.g. for the removal of concentrated waste) and must be justified in the project planning documents. As an example, it may be necessary to use hexane when analyzing for trace levels of pesticides, PCBs, or fuels. In addition, because many of these solvents are not miscible in water, the equipment should be air dried prior to use. Solvents should not be used on PVC equipment or well construction materials.

Steam Pressure Washing - This method employs a high pressure spray of heated potable water. This method through the application of heat provides for the removal of various organic/inorganic compounds.

## 4.0 RESPONSIBILITIES

Project Manager - Responsible for ensuring that all field activities are conducted in accordance with approved project plan(s) requirements.

Field Operations Leader (FOL) - Responsible for the onsite verification that all field activities are performed in compliance with approved Standards Operating Procedures or as otherwise dictated by the approved project plan(s).

Site Health and Safety Officer (SHSO) - The SHSO exercises shared responsibility with the FOL concerning decontamination effectiveness. All equipment arriving on-site (as part of the equipment inspection), leaving the site, moving between locations are required to go through a decontamination evaluation. This is accomplished through visual examination and/or instrument screening to determine the effectiveness of the decontamination process. Failure to meet these objectives are sufficient to restrict equipment from entering the site/exiting the site/ or moving to a new location on the site until the objectives are successfully completed.

## 5.0 PROCEDURES

The process of decontamination is accomplished through the removal of contaminants, neutralization of contaminants, or the isolation of contaminants. In order to accomplish this activity a level of preparation is required. This includes site preparation, equipment selection, and evaluation of the process. Site contaminant types, concentrations, media types, are primary drivers in the selection of the types of decontamination as well as where it will be conducted. For purposes of this SOP discussion will be provided concerning general environmental investigation procedures.

The decontamination processes are typically employed at:

- Temporary Decontamination Pads/Facilities
- Sample Locations
- Centralized Decontamination Pad/Facilities
- Combination of some or all of the above

The following discussion represents recommended site preparation in support of the decontamination process.

### 5.1 Decontamination Design/Constructions Considerations

#### 5.1.1 Temporary Decontamination Pads

Temporary decontamination pads are constructed at satellite locations in support of temporary work sites. These structures are generally constructed to support the decontamination of heavy equipment such as drill rigs and earth moving equipment but can be employed for smaller articles.

The purpose of the decontamination pad is to contain wash waters and potentially contaminated soils generated during decontamination procedures. Therefore, construction of these pads should take into account the following considerations

- Site Location – The site selected should be within a reasonable distance from the work site but should avoid:

  - Pedestrian/Vehicle thoroughfares
  - Areas where control/custody cannot be maintained
  - Areas where a potential releases may be compounded through access to storm water transport systems, streams or other potentially sensitive areas.
  - Areas potentially contaminated.

- Pad – The pad should be constructed to provide the following characteristics

  - Size – The size of the pad should be sufficient to accept the equipment to be decontaminated as well as permitting free movement around the equipment by the personnel conducting the decontamination.

  - Slope – An adequate slope will be constructed to permit the collection of the water and potentially contaminated soils within a trough or sump constructed at one end. The collection point for wash waters should be of adequate distance that the decontamination workers do not have to walk through the wash waters while completing their tasks.

  - Sidewalls – The sidewalls should be a minimum of 6-inches in height to provide adequate containment for wash waters and soils. If splash represents a potential problem, splash guards should be constructed to control overspray. Sidewalls maybe constructed of wood, inflatables, sand bags, etc. to permit containment.

  - Liner – Depending on the types of equipment and the decontamination method the liner should be of sufficient thickness to provide a puncture resistant barrier between the decontamination operation and the unprotected environment. Care should be taken to examine the surface area prior to placing the liner to remove sharp articles (sticks, stones, debris) that could puncture the liner. Liners are intended to form an impermeable barrier. The thickness may vary from a minimum recommended thickness of 10 mil to 30 mil. Achieving the desired thickness maybe achieved through layering lighter constructed materials. It should be noted that various materials (rubber, polyethylene sheeting) become slippery when wet. To minimize this potential hazard associated with a sloped liner a light coating of sand maybe applied to provide traction as necessary.

  - Wash/drying Racks – Auger flights, drill/drive rods require racks positioned off of the ground to permit these articles to be washed, drained, and dried while secured from falling during this process. A minimum ground clearance of 2-feet is recommended.

  - Maintenance – The work area should be periodically cleared of standing water, soils, and debris. This action will aid in eliminating slip, trip, and fall hazards. In addition, these articles will reduce potential backsplash and cross contamination. Hoses should be gathered when not in use to eliminate potential tripping hazards.

### 5.1.2 Decontamination Activities at Drill Rigs/DPT Units

During subsurface sampling activities including drilling and direct push activities decontamination of drive rods, Macro Core Samplers, split spoons, etc. are typically conducted at an area adjacent to the operation. Decontamination is generally accomplished using a soap/water wash and rinse utilizing buckets and brushes. This area requires sufficient preparation to accomplish the decontamination objectives.

Buckets shall be placed within mortar tubs or similar secondary containment tubs to prevent splash and spills from reaching unprotected media. Drying racks will be employed as directed for temporary pads to permit parts to dry and be evaluated prior to use/re-use.

#### 5.1.3 Decontamination Activities at Remote Sample Locations

When sampling at remote locations sampling devices such as trowels, pumps/tubing should be evacuated of potentially contaminated media to the extent possible. This equipment should be wrapped in plastic for transport to the temporary/centralized decontamination location for final cleaning and disposition.

### 5.2 Equipment Decontamination Procedures

The following represents procedures to be employed for the decontamination of equipment that may have contacted and/or accumulated contamination through site investigation activities.

#### 5.2.1 Monitoring Well Sampling Equipment

5.2.1.1 Groundwater sampling pumps – This includes pumps inserted into the monitoring well such as Bladder pumps, Whale pumps, Redi-Flo, reusable bailers, etc.

1) Evacuate to the extent possible, any purge water within the pump.

2) Scrub using soap and water and/or steam clean the outside of the pump and tubing, where applicable.

3) Insert the pump and tubing into a clean container of soapy water. Pump a sufficient amount of soapy water through the pump to flush any residual purge water. Once flushed, circulate soapy water through the pump to ensure the internal components are thoroughly flushed.

4) Remove the pump and tubing from the container, rinse external components using tap water. Insert the pump and tubing into a clean container of tap water. Pump a sufficient amount of tap water through the pump to evacuate all of the soapy water (until clear).

5) Rinse equipment with pesticide grade isopropanol

6) Repeat item #4 using deionized water through the hose to flush out the tap water and solvent residue as applicable*.

7) Drain residual deionized water to the extent possible, allow components to air dry.

8) Wrap pump in aluminum foil or a clear clean plastic bag for storage.

5.2.1.2 Electronic Water Level Indicators/Sounders/Tapes

During water level measurements, rinsing with the extracted tape and probe with deionized water and wiping the surface of the extracted tape is acceptable. However, periodic full decontamination should be conducted as indicated below.

* - The solvent should be employed when samples contain oil, grease, PAHs, PCBs, and other hard to remove materials. If these are not of primary concern, the solvent step may be omitted. In addition, do not rinse PE, PVC, and associated tubing with solvents.

1) Wash with soap and water
2) Rinse with tap water
3) Rinse with deionized water

**Note:** In situations where oil, grease, free product, other hard to remove materials are encountered probes and exposed tapes should be washed in hot soapy water.

5.2.1.3 Miscellaneous Equipment

Miscellaneous equipment including analytical equipment (water quality testing equipment) should be cleaned per manufacturer's instructions. This generally includes wiping down the sensor housing and rinsing with tap and deionized water.

Coolers/Shipping Containers employed to ship samples are received from the lab in a variety of conditions from marginal to extremely poor. Coolers should be evaluated prior to use for

- Structural integrity – Coolers missing handles or having breaks within the outer housing should be removed and not used. Notify the laboratory that the risk of shipping samples will not be attempted and request a replacement unit.

- Cleanliness – As per protocol only volatile organic samples are accompanied by a trip blank. If a cooler's cleanliness is in question (visibly dirty/stained) or associated with noticeable odors it should be decontaminated prior to use.

  1) Wash with soap and water
  2) Rinse with tap water
  3) Dry

If these measures fail to clean the cooler to an acceptable level, remove the unit from use as a shipping container and notify the laboratory to provide a replacement unit.

**5.2.2 Down-Hole Drilling Equipment**

This includes any portion of the drill rig that is over the borehole including auger flights, drill stems, rods, and associated tooling that would extend over the borehole. This procedure is to be employed prior to initiating the drilling/sampling activity, then between locations.

1) Remove all soils to the extent possible using shovels, scrapers, etc. to remove loose soils.
2) Through a combination of scrubbing using soap and water and/or steam cleaning remove visible dirt/soils.
3) Rinse with tap water.
4) Rinse equipment with pesticide grade isopropanol
5) To the extent possible allow components to air dry.
6) Wrap or cover equipment in clear plastic until it is time to be used.

**5.2.3 Soil/Sediment Sampling Equipment**

This consists of soil sampling equipment including but not limited to hand augers, stainless steel trowels/spoons, bowls, dredges, scoops, split spoons, Macro Core samplers, etc.

1) Remove all soils to the extent possible.

2) Through a combination of scrubbing using soap and water and/or steam cleaning remove visible dirt/soils.

3) Rinse with tap water.

4) Rinse equipment with pesticide grade isopropanol

5) Rinse with deionized water

6) To the extent possible allow components to air dry.

7) If the device is to be used immediately, screen with a PID/FID to insure all solvents (if they were used) and trace contaminants have been adequately removed.

8) Once these devices have been dried wrap in aluminum foil for storage until it is time to be used.

## 5.3 Contact Waste/Materials

During the course of field investigations disposable/single use equipment becomes contaminated. These items include tubing, trowels, PPE (gloves, overboots, splash suits, etc.) broken sample containers.

With the exception of the broken glass, single use articles should be cleaned (washed and rinsed) of visible materials and disposed of as normal refuse. The exception to this rule is that extremely soiled materials that cannot be cleaned should be containerized for disposal in accordance with applicable federal state and local regulations.

### 5.3.1 Decontamination Solutions

All waste decontamination solutions and rinses must be assumed to contain the hazardous chemicals associated with the site unless there are analytical or other data to the contrary. The waste solution volumes could vary from a few gallons to several hundred gallons in cases where large equipment required cleaning.

Containerized waste rinse solutions are best stored in 55-gallon drums (or equivalent containers) that can be sealed until ultimate disposal at an approved facility. These containers must be appropriately labeled.

## 5.4 Decontamination Evaluation

Determining the effectiveness of the decontamination process will be accomplished in the following manner

- Visual Evaluation – A visual evaluation will be conducted to insure the removal of particulate matter. This will be done to insure that the washing/rinsing process is working as intended.

- Instrument Screening – A PID and/or an FID should be used to evaluate the presence of the contaminants or solvents used in the cleaning process. The air intake of the instrument should be passed over the article to be evaluated. A positive detection requires a repeat the decontamination process. It should be noted that the instrument scan is only viable if the contaminants are detectable within the instruments capabilities.

- Rinsate Blanks – It is recommended that Rinsate samples be collected to
  - Evaluate the decontamination procedure representing different equipment applications (pumps versus drilling equipment) and different decontamination applications.
  - Single use disposable equipment – The number of samples should represent different types of equipment as well as different Lot Numbers of single use articles.

The collection and the frequency of collection of rinsate samples are as follows:

- Per decontamination method
- Per disposable article/Batch number of disposable articles

It is recommended that an initial rinsate sample be collected early in the project to ensure that the decontamination process is functioning properly and in an effort to avoid using a contaminated batch of single use articles. It is recommended that a follow up sample be collected during the execution of the project to insure those conditions do not change. Lastly, rinsate samples collection may be driven by types of and/or contaminant levels. Hard to remove contaminants, oils/greases, some PAHs/PCBs, etc. may also support the collection of additional rinsates due to the obvious challenges to the decontamination process. This is a field consideration to be determined by the FOL.

# APPENDIX B

# QAPP WORKSHEETS

## QAPP Worksheet #1
## Title and Approval Page

Document Title: ***QAPP for Test Pit Investigation at Site 3 – Ninth Street Landfill***

Lead Organization: **Naval Facilities Engineering Command Base Realignment and Closing Project Management Office Northeast (NAVFAC BRAC PMO Northeast)**

Preparer's Name and Organizational Affiliation: ***Megan N. Ritchie, Tetra Tech, NUS, Inc.***

Preparer's Address, Telephone Number, and E-mail Address: ***600 Clark Avenue Suite 3 King of Prussia, PA 19406 610.491.9688 megan.ritchie@ttnus.com***

Preparation Date (Day/Month/Year): ***30-Mar-07***

Investigative Organization's Project Manager/Date: Russell E Turner

Signature

Printed Name/Organization: Russell Turner / Tetra Tech NUS, Inc.

Investigative Organization's Project QA Officer/Date: Kelly A Carper

Signature

Printed Name/Organization: Kelly Carper / Tetra Tech NUS, Inc.

Lead Organization's Project Manager/Date: Curtis A Frye

Signature

Printed Name/Organization: Curtis Frye / NAVFAC BRAC PMO Northeast

---

Approval Signatures:

Signature
Printed Name/Title/Date

Approval Authority

Signature
Printed Name/Title/Date

Approval Authority

Other Approval Signatures:

Signature

Printed Name/Title/Organization/Date

## QAPP Worksheet #2 -- QAPP Identifying Information

| | |
|---|---|
| **Site Number/Code:** | **Site 3** |
| **Operable Unit:** | **N/A** |
| **Contractor Name:** | **Tetra Tech NUS, Inc.** |
| **Contractor Number:** | **N62472-03-D-0057** |
| **Contract Title:** | **CLEAN** |
| **Work Assignment Number:** | **CTO 003** |

1. Identify guidance used to prepare QAPP:
UFP-QAPP Guidance, USEPA QA/R-5, USEPA QA/G-5

2. Identify regulatory program: Remedial Investigation (RI)

3. Identify approval entity: Navy (Mid-Atlantic)

4. Indicate whether the QAPP is a generic or ~~a~~ ***project-specific*** QAPP. (circle one)

5. List dates of scoping sessions that were held:
3/29/2007
General scoping sessions:

6. List dates and titles of QAPP documents written for previous site work, if applicable:

| Title | Received Date |
|---|---|
| N/A | |
| | |
| | |

7. List organizational partners (stakeholders) and connection with lead organization:
EPA (regulatory oversight), PADEP (regulatory oversight), NAVFAC (property owner)

8. List data users:
EPA (regulatory oversight), PADEP (regulatory oversight), NAVFAC (property owner), Tetra Tech NUS, (Investigation Contractor)

9. If any required QAPP elements and required information are not applicable to the project, then circle the omitted QAPP elements and required information on the attached table. Provide an explanation for their exclusion below:

Circle QAPP elements and required information that are not applicable to the project. Provide an explanation in the QAPP.

| Required QAPP Element(s) and Corresponding QAPP Section(s) | Crosswalk to Required Documents | Optional QAPP Worksheet # in QAPP Workbook | Required Information |
|---|---|---|---|
| **Project Management and Objectives** | | | |
| Title and Approval Page | | 1 | - Title and Approval Page |
| 1.1 Document Format<br>1.1.1 Document Control Format<br>1.1.2 Document Control Numbering System<br>1.1.3 QAPP Identifying Information | | 2 | - Table of Contents<br>- QAPP Identifying Information |
| 1.2 Distribution List and Project Personnel Sign-Off Sheet<br>1.2.1 Distribution List<br>1.2.2 Project Personnel Sign-Off Sheet | | 3<br>4 | - Distribution List<br>- Project Personnel Sign-Off Sheet |
| 1.3 Project Organization<br>Project Organizational Chart<br>1.3.1 Communication Pathways<br>1.3.2 Personnel Responsibilities and Qualifications<br>1.3.3 Special Training Requirements and Certification | | 5<br>6<br>7<br>8 | - Project Organizational Chart<br>- Communication Pathways<br>- Personnel Responsibilities and Qualifications Table<br>- Special Personnel Training Requirements Table |
| 1.4 Project Planning/Problem Definition<br>1.4.1 Project Planning (Scoping)<br>1.4.2 Problem Definition, Site History, and Background | WP Sections 2.2 through 2.4 | 9<br>10 | - Project Planning Session Documentation (including Data Needs tables)<br>- Project Scoping Session Participants Sheet<br>- Problem Definition, Site History, and Background<br>- Site Maps (historical and present) |
| 1.5 Project Quality Objectives and Measurement Performance Criteria<br>1.5.1 Development of Project Quality Objectives Using the Systematic Planning Process<br>1.5.2 Measurement Performance Criteria | | 11<br>12 | - Site-Specific PQOs<br>- Measurement Performance Criteria Table |
| 1.6 Secondary Data Evaluation | | 13 | - Sources of Secondary Data and Information<br>- Secondary Data Criteria and Limitations Table |
| 1.7 Project Overview and Schedule<br>1.7.1 Project Overview<br>1.7.2 Project Schedule | | 14<br>15<br>16 | - Summary of Project Tasks<br>- Reference Limits and Evaluation Table<br>- Project Schedule/Timeline Table |

| Required QAPP Element(s) and Corresponding QAPP Section(s) | Crosswalk to Required Documents | Optional QAPP Worksheet # in QAPP Workbook | Required Information |
|---|---|---|---|
| **Measurement/Data Acquisition** | | | |
| 2.1 Sampling Tasks<br>2.1.1 Sampling Process Design and Rationale<br>2.1.2 Sampling Procedures and Requirements<br>2.1.2.1 Sampling Collection Procedures<br>2.1.2.2 Sample Containers, Volume, and Preservation<br>2.1.2.3 Equipment/Sample Containers Cleaning and Decontamination Procedures<br>2.1.2.4 Field Equipment Calibration, Maintenance, Testing, and Inspection Procedures<br>2.1.2.5 Supply Inspection and Acceptance Procedures<br>2.1.2.6 Field Documentation Procedures | | 17<br>18<br>19<br>20<br>21<br>22 | - Sampling Design and Rationale<br>- Sample Location Map<br>- Sampling Locations and Methods/ SOP Requirements Table<br>- Analytical Methods/SOP Requirements Table<br>- Field Quality Control Sample Summary Table<br>- Sampling SOPs<br>- Project Sampling SOP References Table<br>- Field Equipment Calibration, Maintenance, Testing, and Inspection Table |
| 2.2 Analytical Tasks<br>2.2.1 Analytical SOPs<br>2.2.2 Analytical Instrument Calibration Procedures<br>2.2.3 Analytical Instrument and Equipment Maintenance, Testing, and Inspection Procedures<br>2.2.4 Analytical Supply Inspection and Acceptance Procedures | | 23<br>24<br>25 | - Analytical SOPs<br>- Analytical SOP References Table<br>- Analytical Instrument Calibration Table<br>- Analytical Instrument and Equipment Maintenance, Testing, and Inspection Table |
| 2.3 Sample Collection Documentation, Handling, Tracking, and Custody Procedures<br>2.3.1 Sample Collection Documentation<br>2.3.2 Sample Handling and Tracking System<br>2.3.3 Sample Custody | | 26<br>27 | - Sample Collection Documentation Handling, Tracking, and Custody SOPs<br>- Sample Container Identification<br>- Sample Handling Flow Diagram<br>- Example Chain-of-Custody Form and Seal |
| 2.4 Quality Control Samples<br>2.4.1 Sampling Quality Control Samples<br>2.4.2 Analytical Quality Control Samples | | 28 | - QC Samples Table<br>- Screening/Confirmatory Analysis Decision Tree |

| Required QAPP Element(s) and Corresponding QAPP Section(s) | Crosswalk to Required Documents | Optional QAPP Worksheet # in QAPP Workbook | Required Information |
|---|---|---|---|
| 2.5 Data Management Tasks<br>2.5.1 Project Documentation and Records<br>2.5.2 Data Package Deliverables<br>2.5.3 Data Reporting Formats<br>2.5.4 Data Handling and Management<br>2.5.5 Data Tracking and Control | | 29<br>30 | - Project Documents and Records Table<br>- Analytical Services Table<br>- Data Management SOPs |
| 2.6 Monitoring Well Inspection Tasks<br>2.6.1 Monitoring Well Inspection<br>2.6.2 Database Review<br>2.6.3 Field Inspection<br>2.6.4 Minor Monitoring Well Maintenance<br>2.6.5 Data Collection<br>2.6.6 Surveying of Monitoring Well Locations<br>2.7 Evaluation/Decision Process<br>2.8 Abandonment/Repair<br>2.9 Equipment Decontamination<br>2.10 Waste Handling | | | |
| **Assessment/Oversight** | | | |
| 3.1 Assessments and Response Actions<br>3.1.1 Planned Assessments<br>3.1.2 Assessment Findings and Corrective Action Responses | | 31<br>32 | - Assessments and Response Actions<br>- Planned Project Assessments Table<br>- Audit Checklists<br>- Assessment Findings and Corrective Action Responses Table |
| 3.2 QA Management Reports | | 33 | - QA Management Reports Table |
| 3.3 Outline of Project Report | | | |
| **Data Review** | | | |
| 4.1 Overview | | | |
| 4.2 Data Review Steps<br>4.2.1 Step I: Verification<br>4.2.2 Step II: Validation<br>42.2.1 Step IIa Validation Activities<br>4.2.2.2 Step IIb Validation Activities<br>4.2.3 Step III: Usability Assessment<br>4.2.3.1 Data Limitations and Actions from Usability Assessment<br>4.2.3.2 Activities | | 34<br>35<br>36<br>37 | - Verification (Step I) Process Table<br>- Validation (Steps IIa and IIb) Process Table<br>- Validation (Steps IIa and IIb) Summary Table<br>- Usability Assessment |
| 4.3 Streamlining Data Review | | | Not Applicable |

## QAPP Worksheet #3

List those entities to whom copies of the approved QAPP, subsequent QAPP revisions, addenda, and amendments.

☐ Worksheet Not Applicable (State Reason)

**Distribution List**

| QAPP Recipients | Title | Organization | Telephone Number | Fax Number | E-mail Address | Document Control Number |
|---|---|---|---|---|---|---|
| Curtis Frye | Remedial Project Manager (RPM) | NAVFAC Mid-Atlantic | 215-897-4914 | 215-897-4902 | curtis.frye@navy.mil | NA |
| Jim Edmond | Facility Contact | Regional Environmental Group (REG) | 215-443-6939 | 215-443-6935 | jim.edmond@navy.mil | NA |
| Lt. Commander Suzanne Montgomery | PWC-DET Coordinator | Public Works Center Detachment (PWC-DET) | 215-443-2229 | 215-443-6251 | suzanne.montgomery@navy.mil | NA |
| Gerald Watkins | Resident Officer in Charge of Construction (ROICC) | NAVFAC Mid-Atlantic | 215-773-2657 | NA | NA | NA |
| Lisa Cunningham | EPA RPM | EPA Region 3 | 215-814-3363 | 215-814-3051 | cunningham.lisa@epamail.gov | NA |
| April Flipse | PADEP | PADEP | 484-250-5721 | 484-250-5961 | aflipse@state.pa.us | NA |
| Russell Turner | Project Manager (PM) | TtNUS | 610-491-9688 | 610-491-9645 | russell.turner@ttnus.com | NA |
| Kelly Carper | Quality Assurance (QA) Officer | TtNUS | 412-921-7273 | 412-921-4040 | kelly.carper@ttnus.com | NA |
| Don Whalen | Field Operations Leader (FOL)/Site Safety Officer(SSO) | TtNUS | 610-491-9688 | 610-491-9645 | don.whalen@ttnus.com | NA |
| Megan Ritchie | Project Chemist | TtNUS | 610-491-9688 | 610-491-9645 | megan.ritchie@ttnus.com | NA |
| Veronica Bortot | Laboratory Project Manager | STL Laboratories | 412-963-7058 | 412-963-2468 | VBortot@stl-inc.com | NA |

## QAPP Worksheet #4

Have copies of this form signed by key project personnel from each organization to indicate that they have read the applicable QAPP sections and will perform the tasks as described. Ask each organization to forward signed sheets to the central project file.

☐ Worksheet Not Applicable (State Reason)

### Project Personnel Sign-Off Sheet

**Organization:** Tetra Tech NUS, Inc.

| Project Personnel | Title | Telephone Number | Signature | Date QAPP Read Email Receipt |
|---|---|---|---|---|
| Russell Turner | PM | 610-491-9688 | | |
| Don Whalen | FOL/SSO | 610-491-9688 | | |
| Kelly Carper | QA Officer | 412-921-7273 | | |
| Joe Samchuck | Data Validation Manager (DVM) | 412-921-8510 | | |
| Megan Ritchie | Project Chemist | 610-491-9688 | | |

### Project Personnel Sign-Off Sheet

**Organization:** STL Laboratories.

| Project Personnel | Title | Telephone Number | Signature | Date QAPP Read Email Recejpt |
|---|---|---|---|---|
| Veronica Bortot | Project Manager | 412-963-7058 | | |

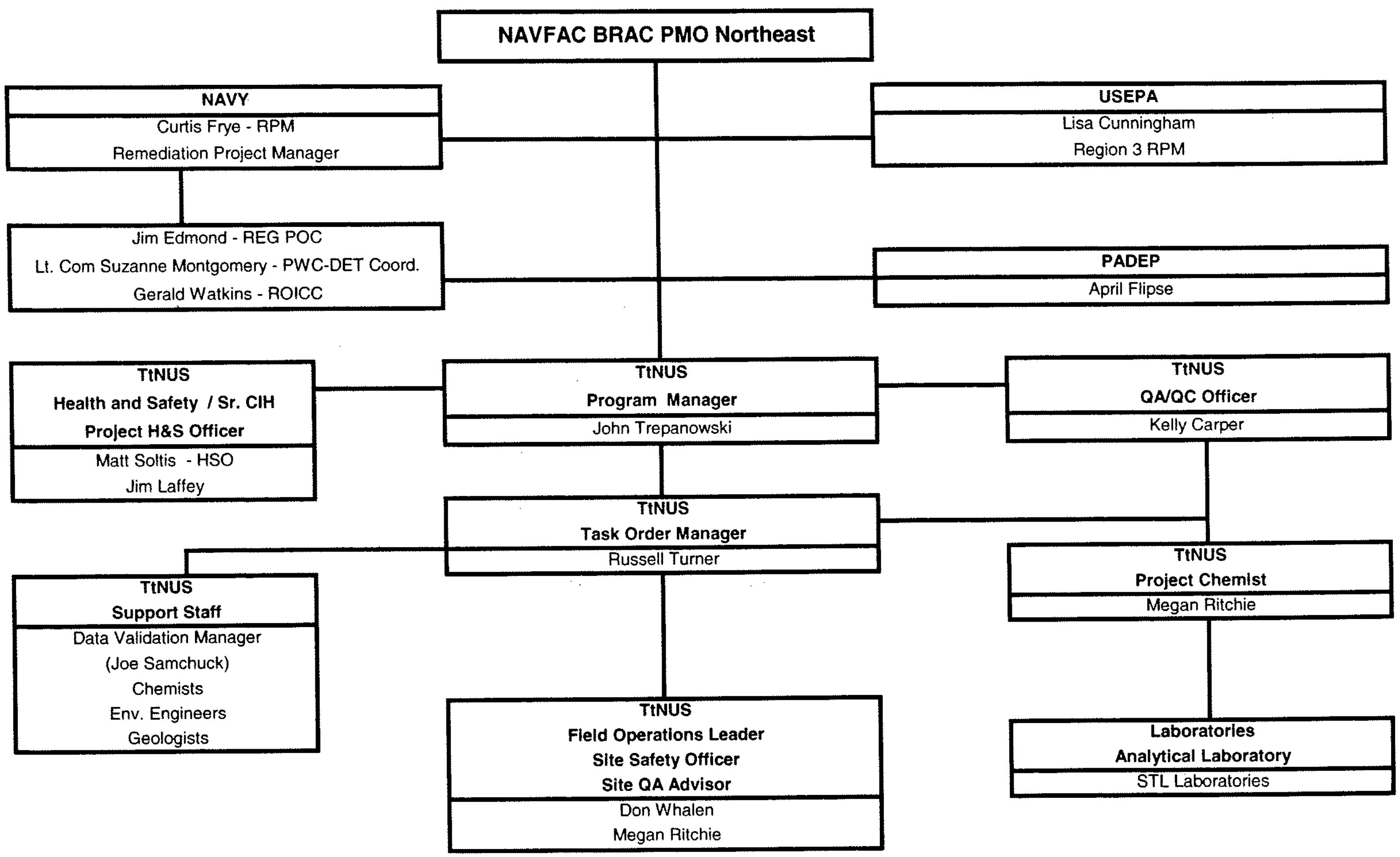
2192

## QAPP Worksheet #5

Identify reporting relationships between all organizations involved in the project, including the lead organization and all contractors and subcontractor organizations. Identify the organizations providing field sampling, on-site and off-site analysis, and data review services, including the names and telephone numbers of all project managers, project team members, and/or project contacts for each organization.

☐ Worksheet Not Applicable (State Reason)

### PROJECT ORGANIZATION CHART



# QAPP Worksheet #6

Describe the communication pathways and modes of communication that will be used during the project, after the QAPP has been approved. Describe the procedures for soliciting and/or obtaining approval between project personnel, between different contractors, and between samplers and laboratory staff. Describe the procedure that will be followed when any project activity originally documented in an approved QAPP requires real-time modification to achieve project goals or a QAPP amendment is required. Describe the procedures for stopping work and identify who is responsible.

☐ Worksheet Not Applicable (State Reason)

## Communication Pathways

| Communication Drivers | Responsible Entity | Name | Phone Number | Procedure (timing, pathways, etc.) |
|---|---|---|---|---|
| Field Task Modification Requests | TtNUS FOL | Don Whalen | 610-491-9688 | Immediately gets approval from TtNUS PM<br>Document via FTMR form |
| QAPP Amendments | Navy RPM | Cutis Frye | 215-897-4914 | Immediately informs TtNUS PM<br>Document via FTMR form |
| Changes in Schedule | TtNUS PM | Russell Turner | 610-491-9688 | Informs Navy via schedule impact letter as soon as impact is realized |
| Issues in the field that result in changes in scope of field work | TtNUS FOL<br>TtNUS PM | Don Whalen<br>Russell Turner | 610-491-9688 | FOL informs PM; PM informs RPM; RPM issues scope change if warranted; Scope change to be implemented before work is executed. |
| Recommendations to stop work and initiate work upon corrective action | TtNUS FOL<br>TtNUS PM<br>TtNUS QA Officer<br>TtNUS Health and Safety Manager (HSM)<br>Navy RPM | Don Whalen<br>Russell Turner<br>Kelly Carper<br>Matt Soltis<br>Curtis Frye | 610-491-9688<br>610-491-9688<br>412-921-7273<br>412-921-8912<br>215-897-4914 | Responsible Party immediately informs subcontractors, the Navy, and Project Team |
| Analytical data quality issues | STL Laboratories<br>TtNUS Project Chemist | Veronica Bortot<br>Megan Ritchie | 412-963-7058<br>610-491-9688 | Immediately notify TtNUS Project Chemist<br>Notify Data Validation Staff and TtNUS PM if necessary |

## QAPP Worksheet #7

Identify project personnel associated with each organization, contractor, and subcontractor participating in responsible roles. Include data users, decision-makers, project managers, QA officers, project contacts for organizations involved in the project, project health and safety officers, geotechnical engineers and hydrogeologists, field operation personnel, analytical services, and data reviewers. Identify project team members with an asterisk (*). Attach resumes to this worksheet or note the location of the resumes.

☐ Worksheet Not Applicable (State Reason)

**Personnel Responsibilities and Qualifications Table**

| Name | Title | Organizational Affiliation | Responsibilities | Education and Experience Qualifications |
|---|---|---|---|---|
| Russell Turner | PM | TtNUS | Oversees project, financial, schedule, and technical day to day management of the project. | B.A. Natural Sciences, 30 years environmental experience |
| Don Whalen | FOL, SSO | TtNUS | Supervises, coordinates, and performs field sampling activities | B.A. Geology, M.S. Marine Studies, 17 years environmental experience |
| Kelly Carper | QA Officer | TtNUS | Reviews QAPP, prepare lab scope, coordinate with lab, and data quality review. Ensure Quality aspects of the CLEAN program. | B.S. Biology, 15 years environmental experience |
| Joe Samchuck | Data Validation Manager | TtNUS | Quality assurance of data validation deliverables. | B.S. Chemistry, MBA, M.S. Finance, 23 years environmental experience |
| Megan Ritchie | Project Chemist | TtNUS | Coordinates analyses with lab chemists, ensures the scope is followed, QA data packages, communicates with TtNUS staff. | B.S. Biology/Environmental Studies, 10 years environmental experience |
| Matt Soltis | Health and Safety Manager | TtNUS | Oversees CLEAN Program Health and Safety Program | B.S. Industrial Safety Sciences, 24 years of environmental experience |

## QAPP Worksheet #8

Provide the following information for those projects requiring personnel with specialized training. Attach training records and/or certificates to the QAPP or note their location.

☑ Worksheet Not Applicable (State Reason)

***INFORMATION PROVIDED IN HEALTH AND SAFETY PLAN***

**Special Personnel Training Requirements Table**

| Project Function | Specialized Training By Title or Description of Course | Training Provider | Training Date | Personnel / Groups Receiving Training | Personnel Titles / Organizational Affiliation | Location of Training Records / Certificates[1] |
|---|---|---|---|---|---|---|
| | | | | | | |
| | | | | | | |
| | | | | | | |
| | | | | | | |
| | | | | | | |
| | | | | | | |
| | | | | | | |
| | | | | | | |
| | | | | | | |
| | | | | | | |
| | | | | | | |
| | | | | | | |

[1] If training records and/or certificates are on file elsewhere, document their location in this column. If training records and/or certificates do not exist or are not available, then this should be noted.

2192

## QAPP Worksheet #9

Complete this worksheet for each project scoping session held. Identify project team members who are responsible for planning the project. The following is the generic form used for scoping meetings.

☐ Worksheet Not Applicable (State Reason)

**Participants Sheet**

| | | | | | |
|---|---|---|---|---|---|
| Project Name: NAS JRB Willow Grove Site 3<br>Projected Date(s) of Sampling: April 30 through May 11, 2007<br>Project Manager: Russell Turner | | Site Name: NAS JRB Willow Grove<br>Site Location: Willow Grove, Pennsylvania | | | |
| **Date of Session: March 2007**<br>**Scoping Session Purpose: Project Planning and Field Sampling Preparation** | | | | | |
| **Name** | **Title** | **Affiliation** | **Phone #** | **E-mail Address** | **Project Role** |
| Russell Turner | PM | TtNUS | 610-491-9688 | rusell.turner@ttnus.com | Management |
| Don Whalen | FOL | TtNUS | 610-491-9688 | Don.whalen@ttnus.com | Task Management |
| Kelly Carper | QA Manager | TtNUS | 412-921-7273 | Kelly.Carper@ttnus.com | QA/QC |
| Megan Ritchie | Project Chemist | TtNUS | 610-491-9688 | Megan.Ritchie@ttnus.com | QA/QC |

Comments/Decisions: Discussed project activities. Distribute worksheet assignments to team members.

Action Items: Complete Worksheets and text for work plan and implement review process.
Consensus Decisions: Worksheets will be completed by Megan Ritchie (project chemist) and then reviewed by technical personnel and QA Manager, Kelly Carper.

**Title:** QAPP for Test Pit Investigation at Site 3 – Ninth Street Landfill

**Site Name/Project Name:** NAS JRB Willow Grove
**Site Location:** Willow Grove, Pennsylvania

**Revision Number:** 0
**Revision Date:** April 2007

## QAPP Worksheet #10

Clearly define the problem and the environmental questions that should be answered for the current investigation and develop the project decision "If …, then…" statements in the QAPP, linking data results with possible actions. The prompts below are meant to help the project team define the problem

☐ Worksheet Not Applicable (State Reason)

-
-

### Problem Definition

**The problem to be addressed by the project:** To locate the Ninth Street Landfill by excavating test pits in the area believed to be the landfill. The purpose the sampling is to use soil analytical results to identity impacted soils and to characterize the nature of the contamination. Previous investigations indicate there is no soil contamination in this area, however, the landfill has not been identified.

**The environmental questions being asked:** Where is the landfill located? Are contaminants present? Are contaminants indicative of the presence of the landfill?

**Observations from any site reconnaissance reports:** An aerial photograph taken in 1964 shows a fenced area measuring approximately 500 feet by 600 feet immediately northwest of Ninth Street (EPA, 1995). This area, shown on Figure 2-3, is presumed to be the landfill. The landfill method consisted of burning the refuse and burying the residue in trenches. Reportedly, the waste disposed of in the landfill consisted mainly of general refuse, but also included paint wastes; paint stripper; TCE; sewage sludge; petroleum, oils and lubricants; and industrial pretreatment plant sludge. After closure of the landfill, a salvage yard operated in the eastern portion of the site.

**A synopsis of secondary data or information from site reports:** See previous paragraph.

**The possible classes of contaminants and the affected matrices:** VOCs, SVOCs, pesticides, PCBs, Dioxin/Furans, metals (including mercury), and cyanide.

**The rationale for inclusion of chemical and non-chemical analyses:** All possible analytical fractions are included to cover items that my have been disposed of in the landfill. See observations above.

**Information concerning various environmental indicators:** Proposed locations for test pits have been selected based upon historical aerial photographs. Previous investigations indicate there is no contamination, however, the location of the landfill has not been identified.

**Project decision conditions (If..., then...@ statements):** If landfill material is located, soil samples will be collected to identify possible contaminants. If landfill material is not located, soil samples will be collected to confirm that no contamination exists in Site 3 soils.

2192

## QAPP Worksheet #11

Use this worksheet to develop project quality objectives (PQOs) in terms of type, quantity, and quality of data determined using a systematic planning process. Provide a detailed discussion of PQOs in the QAPP. List the PQOs in the form of qualitative and quantitative statements. These statements should answer questions such as those listed below. These questions are examples only, however; they are neither inclusive nor appropriate for all projects.

☐ Worksheet Not Applicable (State Reason)

### Project Quality Objectives/Systematic Planning Process Statements

**Who will use the data?**
Navy and Tetra Tech NUS.

**What will the data be used for?**
Identify landfill location. Characterize the nature of contamination in subsurface soil if present.

**What types of data are needed (matrix, target analytes, analytical groups, field screening, on-site analytical or off-site laboratory techniques, sampling techniques)?**

Field Screening: Test pit observations and PID readings.
Fixed-based lab data to be used to characterize soil contamination. Soils analyzed for VOCs, SVOCs, pesticides, PCBs, Dioxin/Furans, metals and cyanide.

**Matrix:** Subsurface Soil

**How "good" do the data need to be in order to support the environmental decision?**
The analytical data will get the fullest level of QC and documentation. Data will undergo 100% validation.

The laboratory must hold a current NELAP accreditation in Pennsylvania and comply with the requirements of NFESC in analytical results reporting and QA/QC.

**How much data are needed (number of samples for each analytical group, matrix, and concentration)?**
Two (2) subsurface soil samples will be collected from each of eight (8) test pits for each analytical group. Concentrations are expected to be low to medium.

**Where, when, and how should the data be collected/generated?**
See Worksheet 18.
Soil sample locations will be selected by visual and olfactory observations in addition to PID readings. If no observations or PID readings are available, samples will be collected from mid-depth at locations equally spaced along the length of the excavation.

# QAPP Worksheet #12

(UFP-QAPP Manual Section 2.6.2)

Complete this worksheet for each matrix, analytical group, and concentration level. Identify the data quality indicators (DQIs), measurement performance criteria (MPC), and QC sample and/or activity used to assess the measurement performance for both the sampling and analytical measurement systems. Use additional worksheets if necessary. If MPC for a specific DQI vary within an analytical parameter, i.e., MPC are analyte-specific, then provide analyte-specific MPC on an additional worksheet.

☐ Worksheet Not Applicable (State Reason)

## Measurement Performance Criteria Table

| | |
|---|---|
| **Matrix** | Soil |
| **Analytical Group** | Volatile Organic Compounds (VOCs) |
| Concentration Level | Low/Medium |

| Sampling Procedure[1] | Analytical Method/SOP[2] | Data Quality Indicators (DQIs) | Measurement Performance Criteria | QC Sample and/or Activity Used to Assess Measurement Performance | QC Sample Assesses Error for Sampling (S), Analytical (A) or Both (S&A) |
|---|---|---|---|---|---|
| Soil Sampling SA-1.3 | SW-846 5035/8260B STL SOP – PITT-MS-0002 | Bias / Contamination | No target analytes ≥1/2 QL; with the exception of common field/laboratory contaminants | Method Blank | A |
| | | Bias / Contamination | No target analytes ≥ QL; with the exception of common field/laboratory contaminants | Trip Blank | S&A |
| | | Accuracy / Bias | Statistically derived limits. | Laboratory Control Spike and Surrogate Standards | A |
| | | Accuracy / Bias / Precision | Retention time ± 30 seconds; EICP area within -50% to +100% of last calibration verification (12 hours) for each IS | Internal Standards | A |
| | | Accuracy / Bias / Precision | Statistically derived limits, 30% RPD | Matrix spike/matrix spike duplicate | A |
| | | Precision | Values > 5X QL: ± 50% | Field Duplicates | S & A |
| | | Bias / Contamination | No target analytes ≥ QL; with the exception of common field/laboratory contaminants | Field/Equipment/Rinsate Blanks | S |

2192

| | | | | | |
|---|---|---|---|---|---|
| | | Accuracy / Representativeness | Between 2 and 6 degrees C. | Cooler Temperature Indicator | S |
| | | Data Completeness | 85% Overall | Data Completeness Check | S & A |
| | | Comparability | Values > 5X QL:<br>Field Duplicates ± 50% | Comparability Check | S & A |
| | | Sensitivity | Quantiation limits less than USEPA Region 3 RBCs listed in Worksheet 15 | Comparability and sensitivity check | S&A |

| | |
|---|---|
| **Matrix** | Soil |
| **Analytical Group** | Semivolatile Organic Compounds (SVOCs) |
| Concentration Level | Low/Medium |

| Sampling Procedure[1] | Analytical Method/SOP[2] | Data Quality Indicators (DQIs) | Measurement Performance Criteria | QC Sample and/or Activity Used to Assess Measurement Performance | QC Sample Assesses Error for Sampling (S), Analytical (A) or Both (S&A) |
|---|---|---|---|---|---|
| Soil Sampling SA-1.3 | SW-846 8270C STL SOP – PITT-OP-0001 PITT-MS-0001 | Bias / Contamination | No target analytes ≥1/2 QL; with the exception of common field/laboratory contaminants | Method Blank | A |
| | | Accuracy / Bias | Statistically derived limits. | Laboratory Control Spike and Surrogate Standards | A |
| | | Accuracy / Bias / Precision | Retention time ± 30 seconds; EICP area within -50% to +100% of last calibration verification (12 hours) for each IS | Internal Standards | A |
| | | Accuracy / Bias / Precision | Statistically derived limits, 30% RPD | Matrix spike/matrix spike duplicate | A |
| | | Precision | Values > 5X QL: ± 50% | Field Duplicates | S & A |
| | | Bias / Contamination | No target analytes ≥ QL; with the exception of common field/laboratory contaminants | Field/Equipment/Rinsate Blanks | S |
| | | Accuracy / Representativeness | Between 2 and 6 degrees C. | Cooler Temperature Indicator | S |
| | | Data Completeness | 85% Overall | Data Completeness Check | S & A |
| | | Comparability | Values > 5X QL: Field Replicates ± 50% | Comparability Check | S & A |
| | | Sensitivity | Quantiation limits less than USEPA Region 3 RBCs listed in Worksheet 15 | Comparability and sensitivity check | S&A |

2192

| | |
|---|---|
| **Matrix** | Soil |
| **Analytical Group** | Pesticides |
| Concentration Level | Low/Medium |

| Sampling Procedure[1] | Analytical Method/SOP[2] | Data Quality Indicators (DQIs) | Measurement Performance Criteria | QC Sample and/or Activity Used to Assess Measurement Performance | QC Sample Assesses Error for Sampling (S), Analytical (A) or Both (S&A) |
|---|---|---|---|---|---|
| Soil Sampling SA-1.3 | SW-846 8081A STL SOP – PITT-OP-0001 PITT-GC-0001 | Bias / Contamination | No target analytes ≥1/2 QL; with the exception of common field/laboratory contaminants | Method Blank | A |
| | | Accuracy / Bias | Statistically derived limits. | Laboratory Control Spike and Surrogate Standards | A |
| | | Accuracy / Bias / Precision | Statistically derived limits, 30% RPD | Matrix spike/matrix spike duplicate | A |
| | | Precision | Values > 5X QL: ± 50% | Field Duplicates | S & A |
| | | Bias / Contamination | No target analytes ≥ QL; with the exception of common field/laboratory contaminants | Field/Equipment/Rinsate Blanks | S |
| | | Accuracy / Representativeness | Between 2 and 6 degrees C. | Cooler Temperature Indicator | S |
| | | Data Completeness | 85% Overall | Data Completeness Check | S & A |
| | | Comparability | Values > 5X QL: Field Replicates ± 50% | Comparability Check | S & A |
| | | Sensitivity | Quantiation limits less than USEPA Region 3 RBCs listed in Worksheet 15 | Comparability and sensitivity check | S&A |

| | |
|---|---|
| **Matrix** | Soil |
| **Analytical Group** | Polychlorinated Biphenyls (PCBs) |
| Concentration Level | Low/Medium |

| Sampling Procedure[1] | Analytical Method/SOP[2] | Data Quality Indicators (DQIs) | Measurement Performance Criteria | QC Sample and/or Activity Used to Assess Measurement Performance | QC Sample Assesses Error for Sampling (S), Analytical (A) or Both (S&A) |
|---|---|---|---|---|---|
| Soil Sampling SA-1.3 | SW-846 8082 STL SOP – PITT-OP-0001 PITT-GC-0001 | Bias / Contamination | No target analytes ≥1/2 QL; with the exception of common field/laboratory contaminants | Method Blank | A |
| | | Accuracy / Bias | Statistically derived limits. | Laboratory Control Spike and Surrogate Standards | A |
| | | Accuracy / Bias / Precision | Statistically derived limits, 30% RPD | Matrix spike/matrix spike duplicate | A |
| | | Precision | Values > 5X QL: ± 50% | Field Duplicates | S & A |
| | | Bias / Contamination | No target analytes ≥ QL; with the exception of common field/laboratory contaminants | Field/Equipment/Rinsate Blanks | S |
| | | Accuracy / Representativeness | Between 2 and 6 degrees C. | Cooler Temperature Indicator | S |
| | | Data Completeness | 85% Overall | Data Completeness Check | S & A |
| | | Comparability | Values > 5X QL: Field Replicates + 50% | Comparability Check | S & A |
| | | Sensitivity | Quantiation limits less than USEPA Region 3 RBCs listed in Worksheet 15 | Comparability and sensitivity check | S&A |

2192

| | |
|---|---|
| **Matrix** | Soil |
| **Analytical Group** | Dioxin/Furans |
| Concentration Level | Low/Medium |

| Sampling Procedure[1] | Analytical Method/SOP[2] | Data Quality Indicators (DQIs) | Measurement Performance Criteria | QC Sample and/or Activity Used to Assess Measurement Performance | QC Sample Assesses Error for Sampling (S), Analytical (A) or Both (S&A) |
|---|---|---|---|---|---|
| Soil Sampling SA-1.3 | SW-846 8290 STL SOP – KNOX-ID-0004 | Bias / Contamination | No target analytes $\geq$1/2 QL; with the exception of common field/laboratory contaminants | Method Blank | A |
| | | Accuracy / Bias | Statistically derived limits. | Laboratory Control Spike and Surrogate Standards | A |
| | | Accuracy / Bias / Precision | Recoveries within -25% to +150% for each IS | Internal Standards | A |
| | | Accuracy / Bias / Precision | Statistically derived limits, 30% RPD | Matrix spike/matrix spike duplicate | A |
| | | Precision | Values > 5X QL: $\pm$ 50% | Field Duplicates | S & A |
| | | Bias / Contamination | No target analytes $\geq$ QL; with the exception of common field/laboratory contaminants | Field/Equipment/Rinsate Blanks | S |
| | | Accuracy / Representativeness | Between 2 and 6 degrees C. | Cooler Temperature Indicator | S |
| | | Data Completeness | 85% Overall | Data Completeness Check | S & A |
| | | Comparability | Values > 5X QL: Field Replicates $\pm$ 50% | Comparability Check | S & A |
| | | Sensitivity | Quantiation limits less than USEPA Region 3 RBCs listed in Worksheet 15 | Comparability and sensitivity check | S&A |

| | |
|---|---|
| **Matrix** | Soil |
| **Analytical Group** | Metals |
| Concentration Level | Low/Medium |

| Sampling Procedure[1] | Analytical Method/SOP[2] | Data Quality Indicators (DQIs) | Measurement Performance Criteria | QC Sample and/or Activity Used to Assess Measurement Performance | QC Sample Assesses Error for Sampling (S), Analytical (A) or Both (S&A) |
|---|---|---|---|---|---|
| Soil Sampling SA-1.3 | SW-846 6010B STL SOP – PITT-IP-0002 PITT-MT-0001 | Bias / Contamination | No target analytes ≥1/2 QL; with the exception of common field/laboratory contaminants and/or Na, K, and Ca | Method Blank | A |
| | | Accuracy / Bias | ± 20% of true value | Laboratory Control Sample | A |
| | | Accuracy / Bias | ± 25% of true value if sample < 4x spike added | Matrix Spike Sample | A |
| | | Precision | Values ≥ 5X QL: RPD ≤20% | Duplicate | S & A |
| | | Accuracy / Bias | If original sample result is at least 50x IDL, 5-fold dilution must agree within ± 10% of the original result. | ICP Serial Dilution | A |
| | | Precision | Values ≥ 5X QL: RPD ≤ 50% | Field Duplicates | S & A |
| | | Bias / Contamination | No target analytes ≥ QL; with the exception of common field/laboratory contaminants and/or Na, K, and Ca | Field/Equipment/Rinsate Blanks | S |
| | | Accuracy / Representativeness | Between 2 and 6 degrees C. | Cooler Temperature Indicator | S |
| | | Data Completeness | 85% Overall | Data Completeness Check | S & A |
| | | Comparability | Values ≥ 5X QL: Field Duplicates; RPD ≤ 50%+ | Comparability Check | S & A |
| | | Sensitivity | Quantiation limits less than USEPA Region 3 RBCs listed in Worksheet 15 | Comparability and sensitivity check | S&A |

2192

| | |
|---|---|
| **Matrix** | Soil |
| **Analytical Group** | Mercury |
| Concentration Level | Low/Medium |

| Sampling Procedure[1] | Analytical Method/SOP[2] | Data Quality Indicators (DQIs) | Measurement Performance Criteria | QC Sample and/or Activity Used to Assess Measurement Performance | QC Sample Assesses Error for Sampling (S), Analytical (A) or Both (S&A) |
|---|---|---|---|---|---|
| Soil Sampling SA-1.3 | SW-846 7471A STL SOP – PITT-MT-0007 | Bias / Contamination | No analyte detected >1/2 QL | Method Blank | A |
| | | Accuracy / Bias | 80-120 %R | Laboratory Control Sample | A |
| | | Accuracy / Bias | 75-125 %R if sample < 4x spike added | Matrix Spike Sample | A |
| | | Precision | Values ≥ 5X QL: RPD ≤ 50% | Field Duplicates | S & A |
| | | Bias / Contamination | No analyte detected >QL | Field/Equipment/Rinsate Blanks | S |
| | | Accuracy / Representativeness | Between 2 and 6 degrees C. | Cooler Temperature Indicator | S |
| | | Data Completeness | 85% Overall | Data Completeness Check | S & A |
| | | Comparability | Values ≥ 5X QL: Field Duplicates; RPD ≤ 50% | Comparability Check | S & A |
| | | Sensitivity | Quantiation limits less than USEPA Region 3 RBCs listed in Worksheet 15 | Comparability and sensitivity check | S&A |

| Matrix | Soil |
|---|---|
| Analytical Group | Cyanide |
| Concentration Level | Low/Medium |

| Sampling Procedure[1] | Analytical Method/SOP[2] | Data Quality Indicators (DQIs) | Measurement Performance Criteria | QC Sample and/or Activity Used to Assess Measurement Performance | QC Sample Assesses Error for Sampling (S), Analytical (A) or Both (S&A) |
|---|---|---|---|---|---|
| Soil Sampling SA-1.3 | SW-846 9012A STL SOP – PITT-WC-0018 | Bias / Contamination | No analyte detected >1/2 QL | Method Blank | A |
| | | Accuracy / Bias | 80-120 %R | Laboratory Control Sample | A |
| | | Accuracy / Bias | 75-125 %R if sample < 4x spike added | Matrix Spike Sample | A |
| | | Precision | Values ≥ 5X QL: RPD ≤ 50% | Field Duplicates | S & A |
| | | Bias / Contamination | No analyte detected >QL | Field/Equipment/Rinsate Blanks | S |
| | | Accuracy / Representativeness | Between 2 and 6 degrees C. | Cooler Temperature Indicator | S |
| | | Data Completeness | 85% Overall | Data Completeness Check | S & A |
| | | Comparability | Values ≥ 5X QL: Field Duplicates; RPD ≤ 50% | Comparability Check | S & A |
| | | Sensitivity | Quantiation limits less than USEPA Region 3 RBCs listed in Worksheet 15 | Comparability and sensitivity check | S&A |

2192

## QAPP Worksheet #13

Identify all secondary data and information that will be used for the project and their originating sources. Specify how the secondary data will be used and the limitations on their use. Each project specific area must include any limitations on use of the data in the final report. Data from each project specific area is accumulated in the final site report and the limits on data use must be presented.

☐ Worksheet Not Applicable (State Reason)

**Secondary Data Criteria and Limitations Table**

| Secondary Data | Data Source (originating organization, report title and date) | Data Generator(s) (originating organization, data types, data generation / collection dates) | How Data Will Be Used | Limitations on Data Use |
|---|---|---|---|---|
| Aerial Photographs | Aerial Photographic Site Analysis, Willow Grove Naval Air Station, Willow Grove, Pennsylvania | USEPA, Characterization Research Division, June 1995 | Data will be used to generate approximate landfill location on topographic/GIS maps and to select proposed test pit locations at Site 3. | None |
| RI Phase I Analytical Data | RI Report for Sites 1, 2, 3, and 5, Naval Air Station Willow Grove, Pennsylvania | Halliburton NUS Environmental Corporation, February 1993 | Data may be used to recalculate environmental risks | None, the data were fully validated. |
| RI Phase II Analytical Data | Draft Phase II RI Report for NAS JRB Willow Grove | Brown and Root Environmental, 1997 | Data may be used to recalculate environmental risks | None, the data were fully validated. |

**Title:** QAPP for Test Pit Investigation at Site 3 – Ninth Street Landfill

**Site Name/Project Name:** NAS JRB Willow Grove
**Site Location:** Willow Grove, Pennsylvania

**Revision Number:** 0
**Revision Date:** April 2007

## QAPP Worksheet #14

Provide a brief overview of the listed project activities. The following table must be completed for each project area.

☐ Worksheet Not Applicable (State Reason)

### Summary of Project Tasks

**Sampling Tasks:**
Grab soil sampling from test pits.

**Analysis Tasks:**
VOCs, SVOCs, pesticides, PCBs, dioxin/furans, metals, and cyanide analysis of soil. PID field instrumentation for volatile gases.

**Quality Control Tasks:**
QA/QC field samples including duplicates, field blanks and trip blanks. Equipment rinsate blanks will only be Lab MS/MSD samples. Chain of custody procedures implemented.

**Secondary Data:**
Aerial photographs and historical analytical data collected for the RI Phase I and II.

**Other Data:**

**Data Management Tasks:**
Incorporate data qualifiers, verify sample IDs, run statistical calculations.

**Documentation and Records:**
Record all field data in logbook. Data validation reporting.

**Assessment / Audit Tasks:**
Routine audits of field personnel, field procedures, and 100% data validation for laboratory analytical data.

**Data Review Tasks:**
Data validation, database QA, calculation/data input technical review.

2192

**WORK SHEET 15**
COMPOUND LIST WITH REQUIRED DETECTION LIMITS AND
SCREENING CRITERIA
SITE 3 - NINTH STREET LANDFILL
NASJRB WILLOW GROVE, PENNSYLVANIA

| | | REGION 3 SOIL RBC | | REGION 3 SOIL TO GW RBC | | LABORATORY METHOD DETECTION (MDL) | LABORATORY QUANTITATION LIMIT (PQL) |
|---|---|---|---|---|---|---|---|
| ORGANIC COMPOUNDS | CAS | Industrial ug/kg | Residential ug/kg | DAF 1 ug/kg | DAF 20 ug/kg | (ug/kg) | (ug/kg) |
| **VOLATILES** | | | | | | | |
| Dichlorodifluoromethane | 75-71-8 | 2.0E+08 N | 1.6E+07 N | 5.5E+02 | 1.1E+04 N | 1.2749 | 5 |
| Chloromethane | 74-87-3 | | | 4.6E+01 | 9.3E+02 N | 1.1073 | 5 |
| Vinyl chloride | 75-01-4 | 4.0E+03 C | 9.0E+01 C | 6.2E-03 | 1.2E-01 C | 1.1143 | 5 |
| Bromomethane | 74-83-9 | 1.4E+06 N | 1.1E+05 N | 2.1E+00 | 4.1E+01 N | 1.2643 | 5 |
| Chloroethane | 75-00-3 | 9.9E+05 C | 2.2E+05 C | 9.6E-01 | 1.9E+01 C | 1.4372 | 5 |
| Trichlorofluoromethane | 75-69-4 | 3.1E+08 N | 2.3E+07 N | 1.1E+03 | 2.3E+04 N | 1.619 | 5 |
| 1,1-Dichloroethene | 75-35-4 | 5.1E+07 N | 3.9E+06 N | 1.5E+02 | 2.9E+03 N | 1.1699 | 5 |
| 1,1,2-Trichloro-1,2,2-trifluoroethane | 76-13-1 | 3.1E+10 N | 2.3E+09 N | 1.2E+05 | 2.3E+06 N | 1.2296 | 5 |
| Acetone | 67-64-1 | 9.2E+08 N | 7.0E+07 N | 1.1E+03 | 2.2E+04 N | 1.1912 | 20 |
| Carbon disulfide | 75-15-0 | 1.0E+08 N | 7.8E+06 N | 9.5E+02 | 1.9E+04 N | 1.2253 | 5 |
| Methyl acetate | 79-20-9 | 1.0E+09 N | 7.8E+07 N | 1.2E+03 | 2.5E+04 N | 1.0591 | 5 |
| Methylene chloride | 75-09-2 | 3.8E+05 C | 8.5E+04 C | 9.5E-01 | 1.9E+01 C | 0.7662 | 5 |
| trans-1,2-Dichloroethene | 156-60-5 | 2.0E+04 N | 1.6E+03 N | 3.6E-02 | 7.2E-01 N | 1.1622 | 5 |
| Methyl tert-butyl ether | 1634-04-4 | 7.2E+05 C | 1.6E+05 C | 5.9E-01 | 1.2E+01 C | 0.9233 | 5 |
| 1,1-Dichloroethane | 75-34-3 | 2.0E+08 N | 1.6E+07 N | 2.6E+02 | 5.1E+03 N | 0.9746 | 5 |
| cis-1,2-Dichloroethene | 156-59-2 | 1.0E+07 N | 7.8E+05 N | 0.0E+00 | 0.0E+00 | 1.0768 | 5 |
| 2-Butanone | 78-93-3 | 6.1E+08 N | 4.7E+07 N | 1.5E+03 | 2.9E+04 N | 0.9704 | 5 |
| Bromochloromethane | 74-97-5 | | | | | 1.1861 | 5 |
| Chloroform | 67-66-3 | 1.0E+07 N | 7.8E+05 N | 4.5E-02 | 9.1E-01 C | 1.0561 | 5 |
| 1,1,1-Trichloroethane | 71-55-6 | 2.9E+08 N | 2.2E+07 N | 1.6E+03 | 3.2E+04 N | 1.0149 | 5 |
| Cyclohexane | 108-94-1 | 5.1E+09 N | 3.9E+08 N | 6.1E+04 | 1.2E+06 N | 0.9971 | 5 |
| Carbon tetrachloride | 56-23-5 | 2.2E+04 C | 4.9E+03 C | 1.1E-01 | 2.1E+00 C | 0.8918 | 5 |
| Benzene | 71-43-2 | 5.2E+04 C | 1.2E+04 C | 9.5E-02 | 1.9E+00 C | 1.0361 | 5 |
| 1,2-Dichloroethane | 107-06-2 | 3.1E+04 C | 7.0E+03 C | 5.2E-02 | 1.0E+00 C | 1.091 | 5 |
| Trichloroethene | 79-01-6 | 7.2E+03 C | 1.6E+03 C | 1.3E-02 | 2.6E-01 C | 1.1185 | 5 |
| Methylcyclohexane | 108-87-2 | | | | | 1.1199 | 5 |
| 1,2-Dichloropropane | 78-87-5 | 4.2E+04 C | 9.4E+03 C | 1.0E-01 | 2.1E+00 C | 1.1078 | 5 |
| Bromodichloromethane | 75-27-4 | 4.6E+04 C | 1.0E+04 C | 5.4E-02 | 1.1E+00 C | 0.9715 | 5 |
| cis-1,3-Dichloropropene | 10061-01-5 | 2.9E+04 C | 6.4E+03 C | 1.6E-01 | 3.1E+00 C | 0.8967 | 5 |
| 4-Methyl-2-pentanone | 108-10-1 | | | 2.9E+03 | 5.9E+04 N | 0.8672 | 5 |
| Toluene | 108-88-3 | 8.2E+07 N | 6.3E+06 N | 1.3E+03 | 2.7E+04 N | 0.7915 | 5 |
| trans-1,3-Dichloropropene | 10061-02-6 | 2.9E+04 C | 6.4E+03 C | 1.6E-01 | 3.1E+00 C | 0.8703 | 5 |
| 1,1,2-Trichloroethane | 79-00-5 | 5.0E+04 C | 1.1E+04 C | 3.9E-02 | 7.8E-01 C | 1.0643 | 5 |
| Tetrachloroethene | 127-18-4 | 5.3E+03 C | 1.2E+03 C | 2.3E-01 | 4.7E+00 C | 1.2987 | 5 |
| 2-Hexanone | 591-78-6 | | | | | 0.7908 | 5 |
| Dibromochloromethane | 124-48-1 | 3.4E+04 C | 7.6E+03 C | 4.1E-02 | 8.3E-01 C | 0.9252 | 5 |
| 1,2-Dibromoethane | 106-93-4 | 1.4E+03 C | 3.2E+02 C | 3.0E-03 | 6.0E-02 C | 1.0399 | 5 |
| Chlorobenzene | 108-90-7 | 2.0E+07 N | 1.6E+06 N | 3.4E+01 | 6.8E+02 N | 1.1083 | 5 |
| Ethylbenzene | 100-41-4 | 1.0E+08 N | 7.8E+06 N | 7.5E+02 | 1.5E+04 N | 1.1795 | 5 |
| o-Xylene | 95-47-6 | 2.0E+08 N | 1.6E+07 N | 1.5E+02 | 3.0E+03 N | 1.0521 | 5 |
| m,p-Xylene | 179601-23-1 | 2.0E+08 N | 1.6E+07 N | 1.5E+02 | 3.0E+03 N | 2.4813 | 10 |
| Styrene | 100-42-5 | 2.0E+08 N | 1.6E+07 N | 2.9E+03 | 5.7E+04 N | 1.1118 | 5 |
| Bromoform | 75-25-2 | 3.6E+05 C | 8.1E+04 C | 3.3E+00 | 6.7E+01 C | 1.0162 | 5 |
| Isopropylbenzene | 98-82-8 | 1.0E+08 N | 7.8E+06 N | 3.2E+03 | 6.4E+04 N | 1.0695 | 5 |
| 1,1,2,2-Tetrachloroethane | 79-34-5 | 1.4E+01 C | 3.2E+00 C | 3.4E-05 | 6.8E-04 C | 1.132 | 5 |
| 1,3-Dichlorobenzene | 541-73-1 | 3.1E+06 N | 2.3E+05 N | 1.5E+01 | 2.9E+02 N | 1.0502 | 5 |
| 1,4-Dichlorobenzene | 106-46-7 | 1.2E+05 C | 2.7E+04 C | 3.6E-01 | 7.1E+00 C | 1.1085 | 5 |
| 1,2-Dichlorobenzene | 95-50-1 | 9.2E+07 N | 7.0E+06 N | 2.3E+02 | 4.6E+03 N | 1.0996 | 5 |
| 1,2-Dibromo-3-chloropropane | 96-12-8 | 3.6E+03 C | 2.0E+02 C | 1.8E-04 | 3.7E-03 C | 0.8403 | 5 |
| 1,2,4-Trichlorobenzene | 120-82-1 | 1.0E+07 N | 7.8E+05 N | 1.2E+02 | 2.4E+03 N | 1.0317 | 5 |
| 1,2,3-Trichlorobenzene | 87-61-6 | | | | | 1.1209 | 5 |
| **SEMIVOLATILES** | | | | | | | |
| Benzaldehyde | 100-52-7 | 1.0E+08 N | 7.8E+06 N | | | 67.9 | 330 |
| Phenol | 108-95-2 | 3.1E+08 N | 2.3E+07 N | 3.3E+03 | 6.7E+04 N | 36.21 | 330 |
| Bis(2-chloroethyl) ether | 111-44-4 | 2.6E+03 C | 5.8E+02 C | 2.2E-03 | 4.4E-02 C | 37.75 | 330 |
| 2-Chlorophenol | 95-57-8 | 5.1E+06 N | 3.9E+05 N | | | 56.97 | 330 |
| 2-Methylphenol | 95-48-7 | 5.1E+07 N | 3.9E+06 N | | | 48.67 | 330 |
| 2,2'-Oxybis(1-choloropropane) | 108-60-1 | 4.1E+04 C | 9.1E+03 C | 8.4E-02 | 1.7E+00 C | 53.79 | 330 |

**WORK SHEET 15**
COMPOUND LIST WITH REQUIRED DETECTION LIMITS AND
SCREENING CRITERIA
SITE 3 - NINTH STREET LANDFILL
NASJRB WILLOW GROVE, PENNSYLVANIA

| ORGANIC COMPOUNDS | CAS | REGION 3 SOIL RBC | | REGION 3 SOIL TO GW RBC | | LABORATORY METHOD DETECTION (MDL) | LABORATORY QUANTITATION LIMIT (PQL) |
|---|---|---|---|---|---|---|---|
| | | Industrial ug/kg | Residential ug/kg | DAF 1 ug/kg | DAF 20 ug/kg | (ug/kg) | (ug/kg) |
| Acetophenone | 98-86-2 | 1.0E+08 N | 7.8E+06 N | 1.6E+02 | 3.2E+03 N | 49.28 | 330 |
| 4-Methylphenol | 106-44-5 | 5.1E+06 N | 3.9E+05 N | | | 74.19 | 330 |
| N-Nitroso-di-n propylamine | 621-64-7 | 4.1E+02 C | 9.1E+01 C | 2.4E-03 | 4.7E-02 C | 33.19 | 330 |
| Hexachloroethane | 67-72-1 | 2.0E+05 C | 4.6E+04 C | 1.8E+01 | 3.6E+02 C | 45.52 | 330 |
| Nitrobenzene | 98-95-3 | 5.1E+05 N | 3.9E+04 N | 1.2E+00 | 2.3E+01 N | 41.17 | 330 |
| Isophorone | 78-59-1 | 3.0E+06 C | 6.7E+05 C | 2.1E+01 | 4.1E+02 C | 43.35 | 330 |
| 2-Nitrophenol | 88-75-5 | | | | | 45.21 | 330 |
| 2,4-Dimethylphenol | 105-67-9 | 2.0E+07 N | 1.6E+06 N | 3.4E+02 | 6.7E+03 N | 28.64 | 330 |
| Bis(2-chloroethoxy) methane | 111-91-1 | | | | | 37.22 | 330 |
| 2,4-Dichlorophenol | 120-83-2 | 3.1E+06 N | 2.3E+05 N | 6.0E+01 | 1.2E+03 N | 34.54 | 330 |
| Naphthalene | 91-20-3 | 2.0E+07 N | 1.6E+06 N | 7.7E+00 | 1.5E+02 N | 34 | 330 |
| 4-Chloroaniline | 106-47-8 | 4.1E+06 N | 3.1E+05 N | 4.8E+01 | 9.7E+02 N | 22.4 | 330 |
| Hexachlorobutadiene | 87-68-3 | 3.7E+04 C | 8.2E+03 C | 9.2E+01 | 1.8E+03 C | 45.4 | 330 |
| Caprolactam | 105-60-2 | 5.1E+08 N | 3.9E+07 N | | | 47.73 | 330 |
| 4-Chloro-3-methylphenol | 59-50-7 | | | | | 28.1 | 330 |
| 2-Methylnaphthalene | 91-57-6 | | | | | 34.3 | 330 |
| Hexachlorocyclopentadiene | 77-47-4 | 6.1E+06 N | 4.7E+05 N | 8.8E+04 | 1.8E+06 N | 22.32 | 1600 |
| 2,4,6-Trichlorophenol | 88-06-2 | 2.6E+05 C | 5.8E+04 C | | | 23.11 | 330 |
| 2,4,5-Trichlorophenol | 95-95-4 | 1.0E+08 N | 7.8E+06 N | | | 31.87 | 330 |
| 1,1'-Biphenyl | 92-52-4 | 5.1E+07 N | 3.9E+06 N | 4.8E+03 | 9.6E+04 N | 38.08 | 330 |
| 2-Chloronaphthalene | 91-58-7 | 8.2E+07 N | 6.3E+06 N | 1.6E+03 | 3.2E+04 N | 29.66 | 330 |
| 2-Nitroaniline | 88-74-4 | | | | | 30.79 | 1600 |
| Dimethylphthalate | 131-11-3 | | | | | 26.86 | 330 |
| 2,6-Dinitrotoluene | 606-20-2 | 1.0E+06 N | 7.8E+04 N | 1.2E+01 | 2.5E+02 N | 24.62 | 330 |
| Acenaphthylene | 208-96-8 | 6.1E+07 N | 4.7E+06 N | 5.2E+03 | 1.0E+05 N | 30.27 | 330 |
| 3-Nitroaniline | 99-09-2 | | | | | 30.97 | 1600 |
| Acenaphthene | 83-32-9 | 6.1E+07 N | 4.7E+06 N | 5.2E+03 | 1.0E+05 N | 26.06 | 330 |
| 2,4-Dinitrophenol | 51-28-5 | 2.0E+06 N | 1.6E+05 N | | | 498.2 | 1600 |
| 4-Nitrophenol | 100-02-7 | | | | | 22.9 | 1600 |
| Dibenzofuran | 132-64-9 | 1.02E+03 N | 7.82E+01 N | | | 31.14 | 330 |
| 2,4-Dinitrotoluene | 121-14-2 | 2.0E+06 N | 1.6E+05 N | 2.9E+01 | 5.7E+02 N | 29.8 | 330 |
| Diethylphthalate | 84-66-2 | 8.2E+08 N | 6.3E+07 N | 2.3E+04 | 4.5E+05 N | 30.41 | 330 |
| Fluorene | 86-73-7 | 4.1E+07 N | 3.1E+06 N | 6.8E+03 | 1.4E+05 N | 28.76 | 330 |
| 4-Chlorophenyl-phenyl ether | 7005-72-3 | | | | | 22.9 | 330 |
| 4-Nitroaniline | 100-01-6 | | | | | 19.09 | 1600 |
| 4,6-Dinitro-2-methylphenol | 534-52-1 | | | | | 21.22 | 1600 |
| N-Nitrosodiphenylamine | 86-30-6 | 5.8E+05 C | 1.3E+05 C | 3.8E+01 | 7.6E+02 C | 37 | 330 |
| 1,2,4,5-Tetrachlorobenzene | 95-94-3 | 3.1E+05 N | 2.3E+04 N | 3.3E+01 | 6.6E+02 N | 19.53 | 330 |
| 4-Bromophenyl-phenylether | 101-55-3 | | | | | 27.45 | 330 |
| Hexachlorobenzene | 118-74-1 | 1.8E+03 C | 4.0E+02 C | | | 27.03 | 330 |
| Atrazine | 1912-24-9 | 1.3E+04 C | 2.9E+03 C | 4.4E-01 | 8.8E+00 C | 47.42 | 330 |
| Pentachlorophenol | 87-86-5 | 2.4E+04 C | 5.3E+03 C | | | 22.68 | 1600 |
| Phenanthrene | 85-01-8 | | | | | 31.51 | 330 |
| Anthracene | 120-12-7 | 3.1E+08 N | 2.3E+07 N | 2.3E+04 | 4.7E+05 N | 31.54 | 330 |
| Carbazole | 86-74-8 | 1.4E+05 C | 3.2E+04 C | 2.3E+01 | 4.7E+02 C | 28.97 | 330 |
| Di-n-butylphthalate | 84-74-2 | 1.0E+08 N | 7.8E+06 N | 2.5E+05 | 5.0E+06 N | 29.63 | 330 |
| Fluoranthene | 206-44-0 | 4.1E+07 N | 3.1E+06 N | 3.1E+05 | 6.3E+06 N | 30.76 | 330 |
| Pyrene | 129-00-0 | 3.1E+07 N | 2.3E+06 N | 3.4E+04 | 6.8E+05 N | 35.84 | 330 |
| Butylbenzylphthalate | 85-68-7 | 2.0E+08 N | 1.6E+07 N | 8.4E+05 | 1.7E+07 N | 35.25 | 330 |
| 3,3'-dicholorobenzidine | 91-94-1 | 6.4E+03 C | 1.4E+03 C | 2.5E-01 | 4.9E+00 C | 19.69 | 1600 |
| Benzo(a)anthracene | 56-55-3 | 3.9E+03 C | 2.2E+02 C | 2.4E+01 | 4.8E+02 C | 32.79 | 330 |
| Chrysene | 218-01-9 | 3.9E+05 C | 2.2E+04 C | 2.4E+03 | 4.8E+04 C | 32.14 | 330 |
| Bis(2-ethylhexyl) phthalate | 117-81-7 | 2.0E+05 C | 4.6E+04 C | 1.4E+05 | 2.9E+06 C | 32.26 | 330 |
| Di-n-octylphthalate | 117-84-0 | | | | | 28.72 | 330 |
| Benzo(b) fluoranthene | 205-99-2 | 3.9E+03 C | 2.2E+02 C | 7.4E+01 | 1.5E+03 C | 44.52 | 330 |
| Benzo(k) fluoranthene | 207-08-9 | 3.9E+04 C | 2.2E+03 C | 7.4E+02 | 1.5E+04 C | 42.72 | 330 |
| Benzo(a) pyrene | 50-32-8 | 3.9E+02 C | 2.2E+01 C | 6.1E+00 | 1.2E+02 C | 30.04 | 330 |
| Indeno(1,2,3,-cd) pyrene | 193-39-5 | 3.9E+03 C | 2.2E+02 C | 2.1E+02 | 4.2E+03 C | 23.35 | 330 |
| Dibenzo(a,h) anthracene | 53-70-3 | 3.9E+02 C | 2.2E+01 C | 2.3E+01 | 4.6E+02 C | 21.95 | 330 |

**WORK SHEET 15**
COMPOUND LIST WITH REQUIRED DETECTION LIMITS AND
SCREENING CRITERIA
SITE 3 - NINTH STREET LANDFILL
NASJRB WILLOW GROVE, PENNSYLVANIA

| ORGANIC COMPOUNDS | CAS | REGION 3 SOIL RBC | | REGION 3 SOIL TO GW RBC | | LABORATORY METHOD DETECTION (MDL) | LABORATORY QUANTITATION LIMIT (PQL) |
|---|---|---|---|---|---|---|---|
| | | Industrial ug/kg | Residential ug/kg | DAF 1 ug/kg | DAF 20 ug/kg | (ug/kg) | (ug/kg) |
| Benzo(g,h,i) perylene | 191-24-2 | | | | | 28.73 | 330 |
| 2,3,4,6-Tetrachlorophenol | 58-90-2 | 3.1E+07 N | 2.3E+06 N | | | 23.3 | 330 |
| 1,4-Dioxane | 123-91-1 | 2.6E+02 C | 5.8E+01 C | 1.3E-03 | 2.6E-02 C | 32.18 | 330 |
| **PESTICIDES** | | | | | | | |
| alpha-BHC | 319-84-6 | 4.5E+02 C | 1.0E+02 C | 4.5E-02 | 8.9E-01 C | 0.254446 | 1.7 |
| beta-BHC | 319-85-7 | 1.6E+03 C | 3.5E+02 C | 1.6E-01 | 3.1E+00 C | 0.19621 | 1.7 |
| delta-BHC | 319-86-8 | | | | | 0.176407 | 1.7 |
| gamma-BHC (Lindane) | 58-89-9 | 2.2E+03 C | 4.9E+02 C | 2.2E-01 | 4.3E+00 C | 0.231286 | 1.7 |
| Heptachlor | 76-44-8 | 6.4E+02 C | 1.4E+02 C | 4.2E+01 | 8.4E+02 C | 0.21266 | 1.7 |
| Aldrin | 309-00-2 | 1.7E+02 C | 3.8E+01 C | 3.8E-01 | 7.7E+00 C | 0.17726 | 1.7 |
| Heptachlor epoxide | 1024-57-3 | 3.1E+02 C | 7.0E+01 C | 1.2E+00 | 2.5E+01 C | 0.167121 | 1.7 |
| Endosulfan I | 959-98-8 | 6.1E+06 N | 4.7E+05 N | 9.8E+02 | 2.0E+04 N | 0.173779 | 1.7 |
| Dieldrin | 60-57-1 | 1.8E+02 C | 4.0E+01 C | 1.1E-01 | 2.2E+00 C | 0.124018 | 1.7 |
| 4,4'-DDE | 72-55-9 | 8.4E+03 C | 1.9E+03 C | 1.8E+03 | 3.5E+04 C | 0.100243 | 1.7 |
| Endrin | 72-20-8 | 3.1E+05 N | 2.3E+04 N | 2.7E+02 | 5.4E+03 N | 0.133271 | 1.7 |
| Endosulfan II | 33213-65-9 | 6.1E+06 N | 4.7E+05 N | 9.8E+02 | 2.0E+04 N | 0.384301 | 1.7 |
| 4,4'-DDD | 72-54-8 | 1.2E+04 C | 2.7E+03 C | 5.6E+02 | 1.1E+04 C | 0.148831 | 1.7 |
| Endosulfan sulfate | 1031-07-8 | 6.1E+06 N | 4.7E+05 N | 9.8E+02 | 2.0E+04 N | 0.270335 | 1.7 |
| 4,4'-DDT | 50-29-3 | 8.4E+03 C | 1.9E+03 C | 5.8E+01 | 1.2E+03 C | 0.228071 | 1.7 |
| Methoxychlor | 72-43-5 | 5.1E+06 N | 3.9E+05 N | 1.5E+04 | 3.1E+05 N | 0.692649 | 3.3 |
| Endrin ketone | 53494-70-5 | 3.1E+05 N | 2.3E+04 N | 2.7E+02 | 5.4E+03 N | 0.194044 | 1.7 |
| Endrin aldehyde | 7421-93-4 | 3.1E+05 N | 2.3E+04 N | 2.7E+02 | 5.4E+03 N | 0.211372 | 1.7 |
| alpha-Chlordane | 5103-71-9 | 8.2E+03 C | 1.8E+03 C | 4.6E+01 | 9.2E+02 C | 0.10378 | 1.7 |
| gamma-Chlordane | 5103-74-2 | 8.2E+03 C | 1.8E+03 C | 4.6E+01 | 9.2E+02 C | 0.170881 | 1.7 |
| Toxaphene | 8001-35-2 | 2.6E+03 C | 5.8E+02 C | 3.1E+01 | 6.3E+02 C | 11.589577 | 67 |
| **PCBS** | | | | | | | |
| Aroclor-1016 | 12674-11-2 | 4.1E+04 C | 5.5E+03 N | 2.1E+02 | 4.2E+03 C | 2.47904 | 16.67 |
| Aroclor-1221 | 11104-28-2 | 1.4E+03 C | 3.2E+02 C | | | 3.18026 | 16.67 |
| Aroclor-1232 | 11141-16-5 | 1.4E+03 C | 3.2E+02 C | | | 2.85338 | 16.67 |
| Aroclor-1242 | 53469-21-9 | 1.4E+03 C | 3.2E+02 C | | | 2.7151 | 16.67 |
| Aroclor-1248 | 12672-29-6 | 1.4E+03 C | 3.2E+02 C | | | 1.57616 | 16.67 |
| Aroclor-1254 | 11097-69-1 | 1.4E+03 C | 3.2E+02 C | 5.4E+01 | 1.1E+03 C | 2.37056 | 16.67 |
| Aroclor-1260 | 11096-82-5 | 1.4E+03 C | 3.2E+02 C | | | 2.36946 | 16.67 |
| Aroclor-1262 | 37324-23-5 | 1.4E+03 C | 3.2E+02 C | 2.1E+01 | 4.1E+02 C | 3.65062 | 16.67 |
| Aroclor-1268 | 11100-14-4 | 1.4E+03 C | 3.2E+02 C | 2.1E+01 | 4.1E+02 C | 2.14116 | 16.67 |
| **Dioxin/Furans** | | | | | | | |
| 2,3,7,8-TCDD | 1746-01-6 | 1.9E-02 C | 4.3E-03 C | 4.3E-04 | 8.6E-03 C | | 0.001 |
| 1,2,3,7,8-PeCDD | 40321-76-4 | | 2.2E-03 | | | | 0.005 |
| 1,2,3,6,7,8-HxCDD | 57653-85-7 | | 4.3E-04 | | | | 0.005 |
| 1,2,3,4,7,8-HxCDD | 39227-28-6 | | 4.3E-04 | | | | 0.005 |
| 1,2,3,7,8,9-HxCDD | 19408-74-3 | | 4.3E-04 | | | | 0.005 |
| 1,2,3,4,6,7,8-HpCDD | 35822-46-9 | | 4.3E-05 | | | | 0.005 |
| OCDD | 3268-87-9 | | 4.3E-06 | | | | 0.01 |
| 2,3,7,8-TCDF | 51207-31-9 | | 4.3E-04 | | | | 0.001 |
| 1,2,3,7,8-PeCDF | 57117-41-6 | | 2.2E-04 | | | | 0.005 |
| 2,3,4,7,8-PeCDF | 57117-31-4 | | 2.2E-03 | | | | 0.005 |
| 1,2,3,6,7,8-HxCDF | 57117-44-9 | | 4.3E-04 | | | | 0.005 |
| 1,2,3,7,8,9-HxCDF | 72918-21-9 | | 4.3E-04 | | | | 0.005 |
| 1,2,3,4,7,8-HxCDF | 70648-26-9 | | 4.3E-04 | | | | 0.005 |
| 2,3,4,6,7,8-HxCDF | 60851-34-5 | | 4.3E-04 | | | | 0.005 |
| 1,2,3,4,6,7,8-HpCDF | 67562-39-4 | | | | | | 0.005 |
| 1,2,3,4,7,8,9-HpCDF | 55673-89-7 | | 4.3E-05 | | | | 0.005 |
| OCDF | 39001-02-0 | | 4.3E-06 | | | | 0.01 |

**WORK SHEET 15**
COMPOUND LIST WITH REQUIRED DETECTION LIMITS AND
SCREENING CRITERIA
SITE 3 - NINTH STREET LANDFILL
NASJRB WILLOW GROVE, PENNSYLVANIA

| ORGANIC COMPOUNDS | CAS | REGION 3 SOIL RBC | | REGION 3 SOIL TO GW RBC | | LABORATORY METHOD DETECTION (MDL) | LABORATORY QUANTITATION LIMIT (PQL) |
|---|---|---|---|---|---|---|---|
| | | Industrial ug/kg | Residential ug/kg | DAF 1 ug/kg | DAF 20 ug/kg | (ug/kg) | (ug/kg) |
| INORGANIC ANALYTES | | REGION 3 SOIL RBC | | REGION 3 SOIL TO GW RBC | | LABORATORY METHOD DETECTION (MDL) | LABORATORY QUANTITATION LIMIT (PQL) |
| | | Industrial mg/kg | Residential mg/kg | DAF 1 mg/kg | DAF 20 mg/kg | (mg/kg) | (mg/kg) |
| Aluminum | 7429-90-5 | 1022000 N | 7.82E+04 N | | | 0.7972 | 20 |
| Antimony | 7440-36-0 | 4.1E+02 N | 3.1E+01 N | 6.6E-01 | 1.3E+01 N | 0.3196 | 1 |
| Arsenic | 7440-38-2 | 1.9E+00 C | 4.3E-01 C | 1.3E-03 | 2.6E-02 C | 0.3293 | 1 |
| Barium | 7440-39-3 | 2.0E+05 N | 1.6E+04 N | 3.0E+02 | 6.0E+03 N | 0.1 | 20 |
| Beryllium | 7440-41-7 | 2.0E+03 N | 1.6E+02 N | 5.8E+01 | 1.2E+03 N | 0.0417 | 0.4 |
| Cadmium | 7440-43-9 | 5.1E+02 N | 3.9E+01 N | 1.4E+00 | 2.7E+01 N | 0.06964 | 0.5 |
| Calcium | 7440-70-2 | | | | | 3.954 | 500 |
| Chromium | 7440-47-3 | 3.1E+03 N | 2.3E+02 N | 2.1E+00 | 4.2E+01 N | 0.09316 | 0.5 |
| Cobalt | 7440-48-4 | | | | | 0.05277 | 5 |
| Copper | 7440-50-8 | 4.1E+04 N | 3.1E+03 N | 5.3E+02 | 1.1E+04 N | 0.1153 | 2.5 |
| Iron | 7439-89-6 | 7.2E+05 N | 5.5E+04 N | | | 1.802 | 10 |
| Lead | 7439-92-1 | 1.0E+03 | 4.0E+02 | | | 0.1586 | 0.3 |
| Magnesium | 7439-95-4 | | | | | 1.024 | 500 |
| Manganese | 7439-96-5 | 2.0E+04 N | 1.6E+03 N | 4.8E+01 | 9.5E+02 N | 0.01139 | 1.5 |
| Mercury | 7439-97-6 | 1.0E+02 N | 7.8E+00 N | | | 0.0071 | 0.033 |
| Nickel | 7440-02-0 | 2.0E+04 N | 1.6E+03 N | | | 0.1234 | 4 |
| Potassium | 7440-9-7 | | | | | 7.5 | 500 |
| Selenium | 7782-49-2 | 5.1E+03 N | 3.9E+02 N | 9.5E-01 | 1.9E+01 N | 0.2617 | 0.5 |
| Silver | 7440-22-4 | 5.1E+03 N | 3.9E+02 N | 1.6E+00 | 3.1E+01 N | 0.02982 | 0.5 |
| Sodium | 7440-23-5 | | | | | 15.66 | 500 |
| Thallium | 7440-28-0 | 7.2E+01 N | 5.5E+00 N | 1.8E-01 | 3.6E+00 N | 0.4558 | 1 |
| Vanadium | 7440-62-2 | 1.0E+03 N | 7.8E+01 N | 3.7E+01 | 7.3E+02 N | 0.1039 | 5 |
| Zinc | 7440-66-6 | 3.1E+05 N | 2.3E+04 N | 6.8E+02 | 1.4E+04 N | 0.1687 | 2 |
| Cyanide | 57-12-5 | 2.0E+04 N | 1.6E+03 N | 7.4E+00 | 1.5E+02 N | 0.0957 | 0.5 |

EPA Region III Risk Based Concentration Screening Values (4/2007), Office of Solid Waste and Emergency Response (OSWER)[for lead only].
Freshwater sediment criteria available at http://www.epa.gov/reg3hwmd/risk/eco/btag/sbv/fwsed/screenbench.htm.
Shaded cells exceed the lowest possible CRQL.

## QAPP Worksheet #16

List all project activities as well as the QA assessments that will be performed during the course of the project. Include the anticipated start and completion dates.

☐ Worksheet Not Applicable (State Reason)

**Project Schedule / Timeline Table**

| Activities | Organization | Dates (MM/DD/YY) | | Deliverable | Deliverable Due Date |
|---|---|---|---|---|---|
| | | Anticipated Date(s) of Initiation | Anticipated Date of Completion | | |
| Test Pits and Soil Sampling | TtNUS | 4/30/2007 | 5/11/2007 | Test Pit Soil Investigation Report Site 3 – Ninth Street Landfill | 7/30/2007 (draft)<br>11/16/2007 (final) |

## QAPP Worksheet #17

Describe the project sampling approach. Provide the rationale for selecting sample locations and matrices for each analytical group and concentration level.

☐ Worksheet Not Applicable (State Reason)

### Sampling Design and Rationale

**Describe and provide a rationale for choosing the sampling approach (e.g., grid system, biased statistical approach):**
Test pits locations were chosen using a biased approach. The proposed test pit locations were placed at Site 3 in areas that are possibly the landfill area based on historical data. See Figure D-1 in the Appendix D. The test pit locations were also chosen in areas that have not been excavated during previous investigations with the exception of the area near former sample B-3. Waste materials were present at this location during the RI, therefore one test pit is proposed at this location.

Two soil samples will be collected at each location from the area with observed contamination or PID readings. If no readings or observation are available, the samples will be taken from mid-depth of the test pit.

For the two dioxin/furan samples, locations will be chosen at areas where burnt waste is encountered.

**Describe the sampling design and rationale in terms of what matrices will be sampled, what analytical groups will and at what concentration levels, the sampling locations (including QC, critical, and background samples), the number of samples to be taken, and the sampling frequency (including seasonal considerations) [May refer to map or Worksheet #18 for details]:**
Soil Sampling
See Worksheet #18

**WORK SHEET 18**
**SAMPLING RECOMMENDATIONS**
**QAPP FOR TEST PIT INVESTIGATION OF SITE 3 - NINTH STREET LANDFILL**
**NAS JRB WILLOW GROVE, PENNSYLVANIA**

| Sampling Location / ID Number | SAMPLE_ID | Matrix | Depth | Analytical Group | Concentration Level | Number of Samples (identify field duplicates) | Sampling SOP Reference | Rationale for Sampling Location |
|---|---|---|---|---|---|---|---|---|
| Site 3 Test Pit 5 | 03TP05-XXXX[1]-01 and DUP-01[2] | Soil | TBD | VOCs | Low to Moderate | 2 | SA-1.3, CT-04, SA-6.1, SA-6.3 | Determine Location of Landfill and contamination |
| | | | | SVOCs | | 2 | | |
| | | | | Pesticides | | 2 | | |
| | | | | PCBs | | 2 | | |
| | | | | Dioxin/Furans[3] | | | | |
| | | | | Metals/Cyanide | | 2 | | |
| | 03TP05-XXXX[1]-02 | | | VOCs | | 1 | | |
| | | | | SVOCs | | 1 | | |
| | | | | Pesticides | | 1 | | |
| | | | | PCBs | | 1 | | |
| | | | | Dioxin/Furans[3] | | | | |
| | | | | Metals/Cyanide | | 1 | | |
| Site 3 Test Pit 6 | 03TP06-XXXX[1]-01 | Soil | TBD | VOCs | Low to Moderate | 1 | SA-1.3, CT-04, SA-6.1, SA-6.3 | Determine Location of Landfill and contamination |
| | | | | SVOCs | | 1 | | |
| | | | | Pesticides | | 1 | | |
| | | | | PCBs | | 1 | | |
| | | | | Dioxin/Furans[3] | | | | |
| | | | | Metals/Cyanide | | 1 | | |
| | 03TP06-XXXX(1)-02 | | | VOCs | | 1 | | |
| | | | | SVOCs | | 1 | | |
| | | | | Pesticides | | 1 | | |
| | | | | PCBs | | 1 | | |
| | | | | Dioxin/Furans[3] | | | | |
| | | | | Metals/Cyanide | | 1 | | |
| Site 3 Test Pit 7 | 03TP07-XXXX[1]-01 | Soil | TBD | VOCs | Low to Moderate | 1 | SA-1.3, CT-04, SA-6.1, SA-6.3 | Determine Location of Landfill and contamination |
| | | | | SVOCs | | 1 | | |
| | | | | Pesticides | | 1 | | |

**WORK SHEET 18**
**SAMPLING RECOMMENDATIONS**
**QAPP FOR TEST PIT INVESTIGATION OF SITE 3 - NINTH STREET LANDFILL**
**NAS JRB WILLOW GROVE, PENNSYLVANIA**

| Sampling Location / ID Number | SAMPLE_ID | Matrix | Depth | Analytical Group | Concentration Level | Number of Samples (identify field duplicates) | Sampling SOP Reference | Rationale for Sampling Location |
|---|---|---|---|---|---|---|---|---|
| | | | | PCBs | | 1 | | |
| | | | | Dioxin/Furans(3) | | | | |
| | | | | Metals/Cyanide | | 1 | | |
| | 03TP07-XXXX(1)-02 | | | VOCs | | 1 | | |
| | | | | SVOCs | | 1 | | |
| | | | | Pesticides | | 1 | | |
| | | | | PCBs | | 1 | | |
| | | | | Dioxin/Furans(3) | | | | |
| | | | | Metals/Cyanide | | 1 | | |
| Site 3 Test Pit 8 | 03TP08-XXXX(1)-01 | Soil | TBD | VOCs | Low to Moderate | 1 | SA-1.3, CT-04, SA-6.1, SA-6.3 | Determine Location of Landfill and contamination |
| | | | | SVOCs | | 1 | | |
| | | | | Pesticides | | 1 | | |
| | | | | PCBs | | 1 | | |
| | | | | Dioxin/Furans(3) | | | | |
| | | | | Metals/Cyanide | | 1 | | |
| | 03TP08-XXXX(1)-02 | | | VOCs | | 1 | | |
| | | | | SVOCs | | 1 | | |
| | | | | Pesticides | | 1 | | |
| | | | | PCBs | | 1 | | |
| | | | | Dioxin/Furans(3) | | | | |
| | | | | Metals/Cyanide | | 1 | | |
| Site 3 Test Pit 9 | 03TP09-XXXX(1)-01 | Soil | TBD | VOCs | Low to Moderate | 1 | SA-1.3, CT-04, SA-6.1, SA-6.3 | Determine Location of Landfill and contamination |
| | | | | SVOCs | | 1 | | |
| | | | | Pesticides | | 1 | | |
| | | | | PCBs | | 1 | | |
| | | | | Dioxin/Furans(3) | | | | |
| | | | | Metals/Cyanide | | 1 | | |
| | 03TP09-XXXX(1)-02 | | | VOCs | | 1 | | |
| | | | | SVOCs | | 1 | | |

**WORK SHEET 18**
**SAMPLING RECOMMENDATIONS**
**QAPP FOR TEST PIT INVESTIGATION OF SITE 3 - NINTH STREET LANDFILL**
**NAS JRB WILLOW GROVE, PENNSYLVANIA**

| Sampling Location / ID Number | SAMPLE_ID | Matrix | Depth | Analytical Group | Concentration Level | Number of Samples (identify field duplicates) | Sampling SOP Reference | Rationale for Sampling Location |
|---|---|---|---|---|---|---|---|---|
| | | | | Pesticides | | 1 | | |
| | | | | PCBs | | 1 | | |
| | | | | Dioxin/Furans(3) | | | | |
| | | | | Metals/Cyanide | | 1 | | |
| Site 3 Test Pit 10 | 03TP10-XXXX(1)-01 and DUP-02(2) | Soil | TBD | VOCs | Low to Moderate | 2 | SA-1.3, CT-04, SA-6.1, SA-6.3 | Determine Location of Landfill and contamination |
| | | | | SVOCs | | 2 | | |
| | | | | Pesticides | | 2 | | |
| | | | | PCBs | | 2 | | |
| | | | | Dioxin/Furans(3) | | | | |
| | | | | Metals/Cyanide | | 2 | | |
| | 03TP10-XXXX(1)-02 | | | VOCs | | 1 | | |
| | | | | SVOCs | | 1 | | |
| | | | | Pesticides | | 1 | | |
| | | | | PCBs | | 1 | | |
| | | | | Dioxin/Furans(3) | | | | |
| | | | | Metals/Cyanide | | 1 | | |
| Site 3 Test Pit 11 | 03TP11-XXXX(1)-01 | Soil | TBD | VOCs | Low to Moderate | 1 | SA-1.3, CT-04, SA-6.1, SA-6.3 | Determine Location of Landfill and contamination |
| | | | | SVOCs | | 1 | | |
| | | | | Pesticides | | 1 | | |
| | | | | PCBs | | 1 | | |
| | | | | Dioxin/Furans(3) | | | | |
| | | | | Metals/Cyanide | | 1 | | |
| | 03TP11-XXXX(1)-02 | | | VOCs | | 1 | | |
| | | | | SVOCs | | 1 | | |
| | | | | Pesticides | | 1 | | |
| | | | | PCBs | | 1 | | |
| | | | | Dioxin/Furans(3) | | | | |
| | | | | Metals/Cyanide | | 1 | | |

WORK SHEET 18
SAMPLING RECOMMENDATIONS
QAPP FOR TEST PIT INVESTIGATION OF SITE 3 - NINTH STREET LANDFILL
NAS JRB WILLOW GROVE, PENNSYLVANIA

| Sampling Location / ID Number | SAMPLE_ID | Matrix | Depth | Analytical Group | Concentration Level | Number of Samples (identify field duplicates) | Sampling SOP Reference | Rationale for Sampling Location |
|---|---|---|---|---|---|---|---|---|
| Site 3 Test Pit 12 | 03TP12-XXXX(1)-01 | Soil | TBD | VOCs | Low to Moderate | 1 | SA-1.3, CT-04, SA-6.1, SA-6.3 | Determine Location of Landfill and contamination |
| | | | | SVOCs | | 1 | | |
| | | | | Pesticides | | 1 | | |
| | | | | PCBs | | 1 | | |
| | | | | Dioxin/Furans(3) | | | | |
| | | | | Metals/Cyanide | | 1 | | |
| | 03TP12-XXXX(1)-02 | | | VOCs | | 1 | | |
| | | | | SVOCs | | 1 | | |
| | | | | Pesticides | | 1 | | |
| | | | | PCBs | | 1 | | |
| | | | | Dioxin/Furans(3) | | | | |
| | | | | Metals/Cyanide | | 1 | | |

(1) XXXX represents depth of the sample. Depth will be determined in the field. For example is sample is collected from 5 to 6 feet the depth will be recorded as 0506.
(2) Field duplicate locations my change in the field based on visual and olfactory observations and PID readings.
(3) Only two locations (plus 1 field duplicate) will be chosen for dioxin analysis based on the presence of burnt waste material.

## QAPP_Worksheet_#19

For each matrix, analytical group, and concentration level, list the analytical and preparation method/SOP and associated sample volume, container specifications, preservation requirements, and maximum holding time.

☐ Worksheet Not Applicable (State Reason)

| Matrix | Analytical Group | Concentration Level | Preparation Method/SOP Reference[1] | Sample Volume | Containers (number, size, and type) | Preservation Requirements (chemical, temperature, light protected) | Maximum (preparation/ analysis) |
|---|---|---|---|---|---|---|---|
| Soil | Volatiles | Low | SW-846 5035/8260B STL SOP-PITT-MS-0002 | 15 grams | 3 – 5 gram Encores | Cool to 4 degrees C; no headspace | 48 hours for preparation; 14 days to analysis |
| Soil | SVOCs | Low | SW-846 3540/8270C STL SOP-PITT-OP-0001 | 250 grams | 1 – 8 oz. wide-mouth glass jar | Cool to 4 degrees C | 14 days to extraction/40 days analysis |
| Soil | Pesticides | Low | SW-846 3540/8081A STL SOP-PITT-OP-0001 | | | | |
| Soil | PCBs | Low | SW-846 3540/8082 STL SOP-PITT-OP-0001 | | | | |
| Soil | Dioxins/Furans | Low | SW-846 8290 STL SOP-KNOX-ID-0004 | 10 grams | 1 – 8 oz. wide-mouth amber glass jar | Cool to 4 degrees C | 30 days from collection to extraction; 45 days from extraction to analysis |
| Soil | Metals | Low | SW-846 7471A STL SOP-PITT-MT-0007 | 250 grams | 1 – 8 oz. wide-mouth glass jar | Cool to 4 degrees C | 180 days to analysis |
| Soil | Mercury | Low | SW-846 9012A STL SOP-PITT-WC-0018 | | | | 28 days to analysis |
| Soil | Cyanide | Low | SW-846 5035/8260B STL SOP-PITT-MS-0002 | | | | 14 days to analysis |

[1]Specify the appropriate reference letter or number from the Analytical SOP References table (Worksheet_#23 ).

**Title:** QAPP for Test Pit Investigation at Site 3 – Ninth Street Landfill

**Site Name/Project Name:** NAS JRB Willow Grove
**Site Location:** Willow Grove, Pennsylvania

**Revision Number:** 0
**Revision Date:** April 2007

## QAPP Worksheet #20

Summarize by matrix, analytical group, and concentration level the number of field QC samples that will be collected and sent to the laboratory.

☐ Worksheet Not Applicable (State Reason)

**Field Quality Control Sample Summary Table**

| Matrix | Analytical Group | Conc. Level | Analytical and Preparation SOP Reference[1] | No. of Sampling Locations | No. of Field Duplicate Pairs | No. of MS | No. of Field Blanks | No. of Equip. Blanks[2] | No. of PT Samples | Total No. of Samples to Lab |
|---|---|---|---|---|---|---|---|---|---|---|
| Soil | Volatiles | Low | SW-846 5035/8260B<br>STL SOP- PITT-MS-0002 | 16 | 2 | 1 | 1 plus 3 trip blanks | 0 | 0 | 23 |
| Soil | SVOCs | Low | SW-846 3540/8270C<br>STL SOP- PITT-OP-0001<br>PITT-MS-0001 | 16 | 2 | 1 | 1 | 0 | 0 | 20 |
| Soil | Pesticides | Low | SW-846 3540/8081A<br>STL SOP- PITT-OP-0001<br>PITT-GC-0001 | 16 | 2 | 1 | 1 | 0 | 0 | 20 |
| Soil | PCBs | Low | SW-846 3540/8082<br>STL SOP- PITT-OP-0001<br>PITT-GC-0001 | 16 | 2 | 1 | 1 | 0 | 0 | 20 |
| Soil | Dioxin/Furans | Low | SW-846 8290<br>STL SOP- KNOX-ID-0004 | 2 | 1 | 1 | 1 | 0 | 0 | 5 |
| Soil | Metals | Low | SW-846 3050/6010B<br>STL SOP- PITT-IP-0002<br>PITT-MT-0001 | 16 | 2 | 1 | 1 | 0 | 0 | 20 |
| Soil | Mercury | Low | SW-846 7471A<br>STL SOP- PITT-MT-0007 | 16 | 2 | 1 | 1 | 0 | 0 | 20 |
| Soil | Cyanide | Low | SW-846 9012A<br>STL SOP- PITT-WC-0018 | 16 | 2 | 1 | 1 | 0 | 0 | 20 |

[1] Specify the appropriate reference letter or number from the Analytical SOP References table (Worksheet #23 ).
[2] No equipment blanks will be collected because dedicated and disposable trowels will be used to collect the samples.

2192

## QAPP Worksheet #21

List all SOPs associated with project sampling including, but not limited to, sample collection, sample preservation, equipment cleaning and decontamination, equipment testing, inspection and maintenance, supply inspection and acceptance, and sample handling and custody. Include copies of the SOPs as attachments or reference all in the QAPP. Sequentially number sampling SOP references in the Reference Number column. The reference number can be used throughout the QAPP to refer to a specific SOP.

☐ Worksheet Not Applicable (State Reason)

**Project Sampling SOP References Table**

| Reference Number | Title, Revision Date and / or Number | Originating Organization | Equipment Type | Modified for Project Work? (Y/N) | Comments |
|---|---|---|---|---|---|
| SA-1.3 | Soil Sampling | TtNUS | Sampling Procedures, Methods | | |
| CT-04 | Sample Nomenclature | TtNUS | NA | Y | Although samples will be soils, the abbreviation "TP" will be used in place of "SB" |
| SA-6.1 | Non-radiological Sample Handling | TtNUS | Sample Bottle ware, Packaging Material, Shipping Materials | | |
| SA-6.3 | Field Documentation | TtNUS | Field Logbook, Field Sample Forms, Boring Logs | | |
| SA-7.1 | Decontamination of Field Equipment | TtNUS | Decontamination Equipment (scrub brushes, phosphate free detergent, de-ionized water) | Y | Decontamination of sampling equipment is not anticipated however if required, Nitric acid removed from decontamination procedure. Isopropyl Alcohol to be used if field conditions warrant |
| ME-12 | Photo-Ionization Detector | TtNUS | Calibration and operation | | |

## QAPP Worksheet #22

Identify all field equipment and instruments (other than analytical instrumentation) that require calibration, maintenance, testing, or inspection and provide the SO reference number for each type of equipment. In addition, document the frequency of activity, acceptance criteria, and corrective action requirements on the worksheet.

☐ Worksheet Not Applicable (State Reason)

### Field Equipment Calibration, Maintenance, Testing, and Inspection Table

| Field Equipment | Calibration Activity | Maint. Activity | Testing Activity | Inspection Activity | Frequency | Acceptance Criteria | Corrective Action | Resp. Person | SOP Reference[1] |
|---|---|---|---|---|---|---|---|---|---|
| Photo-Ionization Detector | Calibration Gas | N/A | Calibrate in accordance with manufacturer specifications | Visual Inspection | Daily | Manufacturer's Guidance | Replace | FOL | ME-12 |
| Backhoe/ Excavating Machinery | N/A | N/A | N/A | Visual Inspection | Daily | Equipment Inspection Sheet Criteria | Replace | FOL | SA-1.3 |
| Disposable Hand Trowel | N/A | N/A | N/A | Visual Inspection | Per Use | N/A | Replace | FOL | SA-1.3 |

[1]Specify the appropriate reference letter or number from the Project Sampling SOP References table (Worksheet #21).

## QAPP Worksheet #23

List all SOPs that will be used to perform on-site or off-site analysis. Indicate whether the procedure produces screening or definitive data. Sequentially number analytical SOP reference in the Reference Number column. Include copies of the SOPs as attachments or reference in the QAPP. The reference number can be used throughout the QAPP to refer to a specific SOP.

☐ Worksheet Not Applicable (State Reason)

### Analytical SOP References Table

| Reference Number | Title, Revision Date, and/or Number | Definitive or Screening Data | Analytical Group | Instrument | Organization Performing Analysis | Modified for Project Work? |
|---|---|---|---|---|---|---|
| STL SOP-PITT-MS-0002 | Volatile Organics by GC/MS Based on Methods 8260B, 624, Rev. 9, 2/12/07 | Definitive | Organic/GC/MS | GC/MS | STL Pittsburgh | ☐ |
| STL SOP-PITT-OP-0001 | Extraction and Cleanup of Organic Compounds from Waters and Solids, Based on SW-846 3500 Series, 3600 Series, 8151A and 600 Series Methods, Rev. 8, 2/1/07 | Definitive | Organic/Extraction | NA/Extraction | STL Pittsburgh | ☐ |
| STL SOP-PITT-MS-0001 | GCMS Analysis Based on Method 8270C and 625, Rev. 7, 1/9/07 | Definitive | Organic/GC/MS | GC/MS | STL Pittsburgh | ☐ |
| STL SOP-PITT-GC-0001 | Chromatographic Analysis Based on Method 8000B, SW-846 8081A, 8082, 8141A, 8151A, 610 and 8310 and 8041, Rev. 10, 1/29/07 | Definitive | Organic/GC | GC/ECD | STL Pittsburgh | ☐ |

**Title:** QAPP for Test Pit Investigation at Site 3 – Ninth Street Landfill

**Site Name/Project Name**: NAS JRB Willow Grove
**Site Location:** Willow Grove, Pennsylvania

**Revision Number:** 0
**Revision Date:** April 2007

## Analytical SOP References Table

| Reference Number | Title, Revision Date, and/or Number | Definitive or Screening Data | Analytical Group | Instrument | Organization Performing Analysis | Modified for Project Work? |
|---|---|---|---|---|---|---|
| STL SOP-KNOX-ID-0004 | Analysis of Polychlorinated Dioxins/Furans by HRGC/HRMS by Methods 8290, 1613B, 23, 0023A, and TO-9A, Revision 7 (or current revision) | Definitive | Specialty Organics Group | Finnigan MAT-95, MAT -95S | STL Knoxville | ☐ |
| STL SOP-PITT-IP-0002 | Acid Digestion of Soils, SW-846 Method 3050B, Rev. 6, 2/1/07 | Definitive | Inorganic/Metals | NA/ Digestion | STL Pittsburgh | ☐ |
| STL SOP-PITT-MT-0001 | Inductively Coupled Plasma-Atomic Emission Spectroscopy, Spectrometric Method for Trace Element Analyses, SW-846 Method 6010B and EPA Method 200.7, Rev. 8, 1/29/07 | Definitive | Inorganic/Metals | ICP-AES | STL Pittsburgh | ☐ |
| STL SOP-PITT-WC-0018 | Cyanide – Semi-Automated, Pyridine-Barbituric Acid For Total and Amenable, Cyanide in Water (Method 335.4/SM 4500-G) and Soil Analyses (Method 9012A), Rev. 10, 1/31/07 | Definitive | Inorganic/Wet Chemistry | Auto analyzer | STL Pittsburgh | ☐ |

2192

## Analytical SOP References Table

| Reference Number | Title, Revision Date, and/or Number | Definitive or Screening Data | Analytical Group | Instrument | Organization Performing Analysis | Modified for Project Work? |
|---|---|---|---|---|---|---|
| STL SOP-PITT-MT-0007 | Preparation and Analysis of Mercury in Solid Samples by Cold Vapor Atomic Absorption Spectroscopy, SW846 7471A and MCAWW 245.5, Rev. 5, 1/10/07 | Definitive | Inorganic/Metals | CVAA | STL Pittsburgh | ☐ |
| STL SOP-PITT-QA-0051 | Sample Receiving and Chain of Custody, Rev. 7, 10/2/06 | Definitive | Sample Receiving | NA/ Log-in | STL Pittsburgh | ☐ |
| STL SOP-PITT-HS-0005 | Sample Disposal, Rev. 1, 4/1/03 | Definitive | Sample Receiving | NA/ Log-in | STL Pittsburgh | ☐ |

**Title:** QAPP for Test Pit Investigation at Site 3 – Ninth Street Landfill

**Site Name/Project Name:** NAS JRB Willow Grove
**Site Location:** Willow Grove, Pennsylvania

**Revision Number:** 0
**Revision Date:** April 2007

## QAPP Worksheet #24

Identify all analytical instrumentation that requires calibration and provide the SOP reference number for each. In addition, document the frequency, acceptance criteria, and corrective action requirements on the worksheet.

☐ Worksheet Not Applicable (State Reason)

Analytical Instrument Calibration Table

| Instrument | Calibration Procedure | Frequency of Calibration | Acceptance Criteria | Corrective Action (CA) | Person Responsible for CA | SOP Reference[1] |
|---|---|---|---|---|---|---|
| GC/MS | Minimum five point calibration for all analytes | Instrument receipt, instrument change (new trap, column, etc.), when CCV does not meet criteria or when manual tune performed. | RSD for each CCC < 30%, minimum mean RF for each SPCC as noted in 7.3.5.4 of method 8260B or 8270C. If RSD for an analyte is > 15% apply linear (r2 > 0.99) or quadratic method for quantitation | Recalibrate and/or perform necessary equipment maintenance. Check calibration standards. Reanalyze affected data. | Analyst/ Supervisor | STL SOPs-PITT-MS-0001 PITT-MS-0002 |
| GC/ECD | Minimum five point calibration for all analytes | Instrument receipt, instrument change (column, etc.), when CCV does not meet criteria. | 20% RSD, Linear corr >0.995, Quadratic corr >0.99 min. 6 pts | Recalibrate and/or perform necessary equipment maintenance. Check calibration standards. Reanalyze affected data. | Analyst/ Supervisor | STL SOP-PITT-GC-0001 |
| HRMS | PFK Mass Resolution Check | At the beginning and end of 12 hour shift | Resolving power>10,000(<100ppm) | Retune Instrument. Adjust slits. | STL HRGC/HRMS analyst | KNOX-ID-0004, current revision |
| HRMS | Initial Calibration (Minimum of 5 calibration levels) | Prior to sample analysis | %RSD<20 for native analytes<br>%RSD<30 for labeled analytes | Initiate remedial action. Repeat initial calibration | STL HRGC/HRMS analyst | KNOX-ID-0004, current revision |

2192

Analytical Instrument Calibration Table

| Instrument | Calibration Procedure | Frequency of Calibration | Acceptance Criteria | Corrective Action (CA) | Person Responsible for CA | SOP Reference[1] |
|---|---|---|---|---|---|---|
| HRMS | CCV of all target analytes (use 3rd calibration standard) | Daily check prior to sample analysis and every 12 hours | Native analytes RRF %D<20<br>Labeled analytes RRF %D<30<br>Ending standard criteria:<br>Native analytes RRF %D<25<br>Labeled analytes RRF<35 | Correct problem, repeat calibration verification, if fails re-establish initial calibration and re-analyze analytical batch. | STL HRGC/HRMS analyst | KNOX-ID-0004, current revision |
| HRMS | Retention Times (CCV evaluation) | Daily prior to sample analysis | All non-target congeners must meet retention time requirements specified in GC Column Performance Check acceptance criteria.<br>Valley Resolution <25% for 2,3,7,8-TCDD (DB-5) and 2,3,7,8-TCDF (DB-225) | Adjust the GC and repeat CCV or recalibrate or replace column | STL HRGC/HRMS analyst | KNOX-ID-0004, current revision |
| CVAA | Minimum five calibration standards and a calibration blank | Every 24-hours or if QC is out of criteria. | Correlation coefficient ≥ 0.995 | Recalibrate and/or perform necessary equipment maintenance. Check calibration standards | Analyst/ Supervisor | STL SOP-PITT-MT-0007 |
| ICP-AES | One point calibration per manufacturer's guidelines | At the beginning of each day or if QC is out of criteria. | One point calibration per manufacturer's guidelines; analytes run at their calibration levels must fall within 90-110% of True Values | Recalibrate and/or perform necessary equipment maintenance. Check calibration standards | Analyst/ Supervisor | STL SOP-PITT-MT-0001 |

Analytical Instrument Calibration Table

| Instrument | Calibration Procedure | Frequency of Calibration | Acceptance Criteria | Corrective Action (CA) | Person Responsible for CA | SOP Reference[1] |
|---|---|---|---|---|---|---|
| Autoanalyzer | Minimum five point calibration | Daily. | Correlation coefficient $\geq$ 0.995 | (1) Investigate source of problem. (2) Re-prepare standards if necessary | Analyst/ Supervisor | STL SOP-PITT-WC-0018 |

[1] Specify the appropriate reference letter or number from the Analytical SOP References table (Worksheet #23).

2192

## QAPP Worksheet #25

Identify all analytical instruments that require maintenance, testing, or inspection and provide the SOP reference number for each. In addition, document the frequency, acceptance criteria, and corrective action requirements on the worksheet.

☐ Worksheet Not Applicable (State Reason)

### Analytical Instrument and Equipment Maintenance, Testing, and Inspection Table

| Instrument/ Equipment | Maintenance Activity | Testing Activity | Inspection Activity | Frequency | Acceptance Criteria | Corrective Action | Responsible Person | SOP Reference1 |
|---|---|---|---|---|---|---|---|---|
| GC/MS | Check pressure and gas supply daily. Bake out trap and column, manual tune if BFB not in criteria, change septa as needed, cut column as needed, change trap as needed. | VOC Analysis | Initial Calibration | Instrument receipt, instrument change (new trap, column, etc.), when CCC does not meet criteria or when manual tune per. | RSD for each CCC < 30%, minimum mean RF for each SPCC as noted in 7.3.5.4 of method 8260B. If RSD for an analyte is > 15% apply linear or quadratic method for quantitation | Recalibrate and/or perform necessary equipment maintenance. Check calibration standards. Reanalyze affected data. | Analyst/ Supervisor | STL SOP-PITT-MS-0002 |
| GC/MS | Check pressure and gas supply daily. Bake out trap and column, manual tune if BFB not in criteria, change septa as needed, cut column as needed, change trap as needed | VOC Analysis | Continuing Calibration | At beginning of each 12 hour shift immediately after BFB tune. | %D for each CCC < 20%, minimum RF for each SPCC as noted in 7.3.5.4 of method 8260B. | Recalibrate and/or perform necessary equipment maintenance. Check calibration standards. Reanalyze affected data. | Analyst/ Supervisor | STL SOP-PITT-MS-0002 |

| Instrument/ Equipment | Maintenance Activity | Testing Activity | Inspection Activity | Frequency | Acceptance Criteria | Corrective Action | Responsible Person | SOP Reference1 |
|---|---|---|---|---|---|---|---|---|
| GC/MS | Check pressure and gas supply daily. Bake out column, manual tune if DFTPP not in criteria, change septa as needed, cut column as needed. | SVOC Analysis | Initial Calibration | Instrument receipt, instrument change (new column, etc.), when CCV does not meet criteria or when manual tune per. | RSD for each CCC < 30%, minimum mean RF for each SPCC as noted in 7.3.5.4 of method 8260B. If RSD for an analyte is > 15% apply linear or quadratic method for quantitation | Recalibrate and/or perform necessary equipment maintenance. Check calibration standards. Reanalyze affected data. | Analyst/ Supervisor | STL SOP-PITT-MS-0001 |
| GC/MS | Check pressure and gas supply daily. Bake out column, manual tune if DFTPP not in criteria, change septa as needed, cut column as needed. | SVOC Analysis | Continuing Calibration | Instrument receipt, instrument change (new column, etc.), when CCV does not meet criteria or when manual tune per. | RSD for each CCC < 30%, minimum mean RF for each SPCC as noted in 7.3.5.4 of method 8260B. If RSD for an analyte is > 15% apply linear or quadratic method for quantitation | Recalibrate and/or perform necessary equipment maintenance. Check calibration standards. Reanalyze affected data. | Analyst/ Supervisor | STL SOP-PITT-MS-0001 |
| HRMS | Replace GC Column | Ability to resolve peaks | As specified in Worksheet 24 | As specified in Worksheet 24 | As specified in Worksheet 24 | As specified in Worksheet 24 | STL HRGC/HRMS, Analyst | KNOX-QA-0003, current revision |
| HRMS | Replace injector port liners | Contamination introduced from sample extracts | None | As Needed | Acceptable GC performance as specified in Worksheet 24. | Replace injector port liners | STL HRGC/HRMS, Analyst | KNOX-QA-0003, current revision |
| HRMS | Clean or replace HRMS detector<br>Cleaning HRMS Sources | HRMS Tuning | As specified in Worksheet 24 | As specified in Worksheet 24 | As specified in Worksheet 24 | As specified in Worksheet 24 | STL HRGC/HRMS, Analyst | KNOX-QA-0003, current revision |
| HRMS | Replace GC septum | Contamination introduced from sample extracts | None | As Needed | Acceptable GC performance as specified in Worksheet 24 | Replace GC septum | STL HRGC/HRMS, Analyst | KNOX-QA-0003, current revision |

2192

| Instrument/ Equipment | Maintenance Activity | Testing Activity | Inspection Activity | Frequency | Acceptance Criteria | Corrective Action | Responsible Person | SOP Reference1 |
|---|---|---|---|---|---|---|---|---|
| HRMS | Vacuum Oil Pumps | Cleanliness of oil | NA | Once per year | NA | Change oil | STL HRGC/HRMS, Analyst | KNOX-QA-0003, current revision |
| ICP-AES | Clean torch assembly and spray chamber when discolored or when degradation in data quality is observed. Clean nebulizer, check argon, and replace peristaltic pump tubing as needed. | Metals Analysis | Initial Calibration | At the beginning of each day or if QC is out of criteria. | ICP uses single point calibration | Recalibrate and/or perform necessary equipment maintenance. Check calibration standards | Analyst/ Supervisor | STL SOP-PITT-MT-0001 |
| ICP-AES | Clean torch assembly and spray chamber when discolored or when degradation in data quality is observed. Clean nebulizer, check argon, and replace peristaltic pump tubing as needed. | Metals Analysis | Initial Calibration Verification | Immediately after instrument calibration | 90-110% of true value for ICP | Recalibrate and/or perform necessary equipment maintenance. Check calibration standards. Reanalyze affected metals. | Analyst/ Supervisor | STL SOP-PITT-MT-0001 |
| ICP-AES | Clean torch assembly and spray chamber when discolored or when degradation in data quality is observed. Clean nebulizer, check argon, and replace peristaltic pump tubing as needed. | Metals Analysis | Continuing Calibration Verification | After every 10 samples and at end of analytical sequence | 90-110% of true value for ICP | Recalibrate and/or perform necessary equipment maintenance. Check calibration standards. Reanalyze affected metals. | Analyst/ Supervisor | STL SOP-PITT-MT-0001 |

**Title:** QAPP for Test Pit Investigation at Site 3 – Ninth Street Landfill

**Site Name/Project Name:** NAS JRB Willow Grove
**Site Location:** Willow Grove, Pennsylvania

**Revision Number:** 0
**Revision Date:** April 2007

| Instrument/ Equipment | Maintenance Activity | Testing Activity | Inspection Activity | Frequency | Acceptance Criteria | Corrective Action | Responsible Person | SOP Reference1 |
|---|---|---|---|---|---|---|---|---|
| GC/ECD | Check pressure and gas supply daily. Bake out column, change septa as needed, cut column as needed. | Pesticide/PCBs | Initial Calibration | Instrument receipt, instrument change (new column, etc.), when CCV does not meet criteria | 20% RSD, Linear Corr. >0.995, Quadratic Corr. >0.99 min. 6 pts. | Recalibrate and/or perform necessary equipment maintenance. Check calibration standards. Reanalyze affected data. | Analyst/ Supervisor | STL SOP PITT-GC-0001 |
| GC/ECD | Check pressure and gas supply daily. Bake out column, change septa as needed, cut column as needed. | Pesticide/PCBs | Continuing Calibration | Instrument receipt, instrument change (new column, etc.), when CCV does not meet criteria | 20% Diff. | Recalibrate and/or perform necessary equipment maintenance. Check calibration standards. Reanalyze affected data. | Analyst/ Supervisor | STL SOP-PITT-GC-0001 |
| CVAA | Clean optical cell when needed. Check lamp, gas pressure, replace peristaltic pump tubing as needed. | Metals Analysis | Initial Calibration | Every 24-hours | Correlation Coefficient > 0.995 | Recalibrate and/or perform necessary equipment maintenance. Check calibration standards | Analyst/ Supervisor | STL SOP-PITT-MT-0007 |
| CVAA | Clean optical cell when needed. Check lamp, gas pressure, replace peristaltic pump tubing as needed. | Metals Analysis | Initial Calibration Verification | Immediately after instrument calibration | 90-110% of true value for ICP | Recalibrate and/or perform necessary equipment maintenance. Check calibration standards. Reanalyze affected samples. | Analyst/ Supervisor | STL SOP-PITT-MT-0007 |
| CVAA | Clean optical cell when needed. Check lamp, gas pressure, replace peristaltic pump tubing as needed. | Metals Analysis | Continuing Calibration Verification | After every 10 samples and at end of analytical sequence | 80-120% of true value for ICP | Recalibrate and/or perform necessary equipment maintenance. Check calibration standards. Reanalyze affected samples. | Analyst/ Supervisor | STL SOP-PITT-MT-0007 |

2192

| Instrument/ Equipment | Maintenance Activity | Testing Activity | Inspection Activity | Frequency | Acceptance Criteria | Corrective Action | Responsible Person | SOP Reference1 |
|---|---|---|---|---|---|---|---|---|
| Autoanalyzer | Fill diluents with fresh DI water daily. Clean incubator. Check syringe plunger tip. | Cyanide Analysis | Initial Calibration | Prior to sample analysis – at least 5 standards plus a blank | R > 0.995 | Recalibrate and/or perform necessary equipment maintenance. Check calibration standards | Analyst/ Supervisor | STL SOP-PITT-WC-0018 |
| Autoanalyzer | Fill diluents with fresh DI water daily. Clean incubator. Check syringe plunger tip. | Cyanide Analysis | Laboratory Control Spike/Initial Calibration Verification | At the beginning of every run and every batch of 20 samples. | Within manufacturer's recommended limits for solid LCS | Recalibrate and/or perform necessary equipment maintenance. Check calibration standards. Reanalyze affected data. | Analyst/ Supervisor | STL SOP-PITT-WC-0018 |
| Autoanalyzer | Fill diluents with fresh DI water daily. Clean incubator. Check syringe plunger tip. | Cyanide Analysis | Continuing Calibration Verification | After every 10 samples and at end of analytical sequence | 90-110% of true value | Recalibrate and/or perform necessary equipment maintenance. Check calibration standards. Reanalyze affected data. | Analyst/ Supervisor | STL SOP-PITT-WC-0018 |

[1]Specify the appropriate reference letter or number from Analytical SOP References table (Worksheet #23).

## QAPP Worksheet #26

Use this worksheet to identify components of the project-specific sample handling system. Record personnel, and their organizational affiliations, who are primarily responsible for ensuring proper handling, custody, and storage of field samples from the time of collection, to laboratory delivery, to final sample disposal. Indicate the number of days field samples and their extracts/digestates will be archived prior to disposal.

☐ Worksheet Not Applicable (State Reason)

### Sample Handling System

| |
|---|
| **SAMPLE COLLECTION, PACKAGING, AND SHIPMENT** |
| Sample Collection (Personnel/Organization): Don Whalen/TtNUS |
| Sample Packaging (Personnel/Organization): Don Whalen/TtNUS |
| Coordination of Shipment (Personnel/Organization): Don Whalen/TtNUS |
| Type of Shipment/Carrier: Overnight courier service (Federal Express) |
| **SAMPLE RECEIPT AND ANALYSIS** |
| Sample Receipt (Personnel/Organization): Sample custodians/STL Laboratories |
| Sample Custody and Storage (Personnel/Organization): Sample custodians/STL Laboratories |
| Sample Preparation (Personnel/Organization): Preparation Laboratory Staff/STL Laboratories |
| Sample Determinative Analysis (Personnel/Organization): GC/MS, ICP, GC/ECD, Spectrophotometer/STL Laboratories |
| **SAMPLE ARCHIVING** |
| Field Sample Storage (No. of days from sample collection): 30 days from submittal of final report |
| Sample Extract/Digestate Storage (No. of days from extraction/digestion): 30 days from submittal of final report |
| Biological Sample Storage (No. of days from sample collection): Not Applicable |
| **SAMPLE DISPOSAL** |
| Personnel/Organization: Sample custodians/STL Laboratories |
| Number of Days from Analysis: 30 days from submittal of final report |

2192

## QAPP Worksheet #27

Describe the procedures that will be used to maintain sample custody and integrity. Include examples of chain-of-custody forms, traffic reports, sample identification, custody seals, laboratory sample receipt forms, and laboratory sample transfer forms. Attach or reference applicable SOPs.

☐ Worksheet Not Applicable (State Reason)

## Sample Custody Requirements

| |
|---|
| Field Sample Custody Procedures (sample collection, packaging, shipment, and delivery to laboratory): Following sample collection into the appropriate bottle ware, all samples will be immediately placed on ice in a cooler. The glass sample containers will be enclosed in bubble-wrap in order to protect the bottle ware during shipment. The cooler will be secured using duct or clear packaging tape along with a signed custody seal. Sample coolers will be delivered to a local courier location for priority overnight delivery to the selected laboratory for analysis. Samples will be preserved as appropriate based on the analytical method. Laboratories will provide pre-preserved sample containers for sample collection. Samples will be maintained at 4° centigrade (degrees C) until delivery to the laboratories. Proper custody procedures will be followed throughout all phases of sample collection and handling. Chain of custody (COC) protocols will be used throughout sample handling to establish the evidentiary integrity of sample containers. These protocols will be used to demonstrate that the samples were handled and transferred in a manner that would eliminate possible tampering. Samples for the laboratory will be packaged and shipped in accordance with TtNUS SOP SA-6.1. |
| Laboratory Sample Custody Procedures (receipt of samples, archiving, disposal): Empirical SOPs 404,405,410 |
| Sample Identification Procedures: Sample nomenclature will be conducted in general accordance with the procedures outlined in TtNUS SOP CT-04 (Sample Nomenclature). Sample nomenclature put forth for this field event has been selected based on historical usage. The sample nomenclature for each tracking number includes the site being investigated, sample media identifier, and sample location number. The standard sample matrix and type codes used for this field event are as follows: "TP" for test pit samples obtained from the test pits. Duplicate samples will be submitted to the laboratory as blind duplicates. Therefore duplicate codes will be reflective of the standard sample matrix code followed by a "DUP" tag and sequentially listed. Due to the blind nature of the duplicate samples, no sample depth or date will be listed with the duplicated sample. An example of a duplicate sample would be "03DUP001". The QA/QC type codes used for this field event are as follows: TB for Trip Blanks and FB for field blanks. Trip blanks and field blanks will be labeled sequentially followed by the date (i.e., TB20070430, FB20070501). Samples to be used for matrix spikes and matrix spike duplicates will be labeled MS/MSD on the bottle label and noted on the chain-of-custody, as required in the laboratory QA Plan; however, "MS/MSD" will not be part of the unique sample identifier in order to maintain consistency with the project database. Additional information regarding protocol for sample labeling is contained in TtNUS SOP SA-6.3 and STL SOP PITT-QA-0051 |
| Chain-of-custody Procedures: After recovery, each sample will be maintained in the sampler's custody until formally transferred to another party (e.g., Federal Express). For all samples recovered, custody records will document the date and time of sample collection, the sampler's name, and the names of all others who subsequently held custody of the sample. Specifications for chemical analyses will also be documented on the custody record. Attached SOP SA-6.3 (Field Documentation) provides further details on the COC procedure. COC requirements are also documented with instructions contained in each shipment from the laboratory. (STL SOP PITT-QA-0051) |

**Title:** QAPP for Test Pit Investigation at Site 3 – Ninth Street Landfill

**Site Name/Project Name:** NAS JRB Willow Grove
**Site Location:** Willow Grove, Pennsylvania

**Revision Number:** 0
**Revision Date:** April 2007

## QAPP Worksheet #28

Complete a separate worksheet for each sampling technique, analytical method/SOP, matrix, analytical group, and concentration level. If method/SOP QC acceptance limits exceed the measurement performance criteria, the data obtained may be unusable for making project decisions.

☐ Worksheet Not Applicable (State Reason)

### QC Samples Table

| | |
|---|---|
| Matrix | Soil |
| Analytical Group | VOCs |
| Concentration Level | Low/Medium |
| Sampling SOP | SA-1.3 |
| Analytical Method/ SOP Reference | SW-846 8260B/STL SOP PITT-MS-0002 |
| Sampler's Name | Don Whalen |
| Field Sampling Organization | Tetra Tech NUS, Inc. |
| Analytical Organization | STL Laboratories |
| No. of Sample Locations | 16 |

| QC Sample: | Frequency/Number | Method/SOP QC Acceptance Limits | Corrective Action | Person(s) Responsible for Corrective Action | Data Quality Indicator (DQI) | Measurement Performance Criteria |
|---|---|---|---|---|---|---|
| Trip Blank | One per cooler of VOC samples shipped to laboratory | No target analytes ≥ QL; with the exception of common field/laboratory contaminants | No corrective action by laboratory. | Data Validator | Bias / Contamination | No target analytes ≥ QL; with the exception of common field/laboratory contaminants. |
| Method Blank | One every 12 hours prior to sample analysis | No target compounds ≥ ½ CRQL except common lab contaminants which should be < RL | Re-clean, retest, re-extract, reanalyze, and/or qualify data. | Analyst, Laboratory Supervisor and Data Validator | Bias / Contamination | No target compounds ≥ ½ CRQL except common lab contaminants which should be < RL. |

2192

| | | | | | | |
|---|---|---|---|---|---|---|
| Surrogates | 3 per sample | Statistically derived limits. | (1) Re-prep and reanalyze for confirmation of matrix interference when appropriate. | Analyst, Laboratory Supervisor and Data Validator | Accuracy / Bias | Statistically derived limits |
| Laboratory Control Spike | One per batch of 20 or less | Statistically derived from lab data or nominal limits depending on the project. Statistical limits are used as default limits. | (1) Evaluate and reanalyze if possible (2) If an MS/MSD was performed in the same 12 hour clock and acceptable narrate. (3) If the LCS recoveries are high but the sample results are <QL narrate otherwise re-prep and reanalyze. | Analyst, Laboratory Supervisor and Data Validator | Precision / Accuracy / Bias | Statistically derived from lab data or nominal limits depending on the project. Statistical limits are used as default limits. |
| Internal Standards | 3 per sample | Retention time ± 30 seconds; EICP area within -50% to +100% of last calibration verification (12 hours) for each IS. | Inspect mass spectrometer or GC for malfunctions; mandatory reanalysis of samples analyzed while system was malfunctioning. | Analyst, Laboratory Supervisor and Data Validator | Precision / Accuracy / Bias | Retention time ± 30 seconds; EICP area within -50% to +100% of last calibration verification (12 hours) for each IS. |
| Matrix spike / Matrix spike duplicate | One per SDG or every 20 samples | Statistically derived from lab data or nominal limits depending on the project. Statistical limits are used as default limits. | (1) CA will not be taken for samples when recoveries are outside limits and surrogate and LCS criteria are met. (2) If both the LCS and MS/MSD are unacceptable re-prep the samples and QC. | Analyst, Laboratory Supervisor and Data Validator | Precision / Accuracy / Bias | Statistically derived from lab data or nominal limits depending on the project. Statistical limits are used as default limits. |

| | |
|---|---|
| Matrix | Soil |
| Analytical Group | SVOCs |
| Concentration Level | Low/Medium |
| Sampling SOP | SA-1.3 |
| Analytical Method/ SOP Reference | SW-846 8270C/STL SOP PITT-MS-0001 |
| Sampler's Name | Don Whalen |
| Field Sampling Organization | Tetra Tech NUS, Inc. |
| Analytical Organization | STL Laboratories |
| No. of Sample Locations | 16 |

| QC Sample: | Frequency/Number | Method/SOP QC Acceptance Limits | Corrective Action | Person(s) Responsible for Corrective Action | Data Quality Indicator (DQI) | Measurement Performance Criteria |
|---|---|---|---|---|---|---|
| Method Blank | One per batch of 20 or less | No target compounds ≥1/2 CRQL except common lab contaminants which should be < RL. | Re-clean, retest, re-extract, reanalyze, and/or qualify data. | Analyst, Laboratory Supervisor and Data Validator | Bias / Contamination | No target compounds ≥1/2 CRQL except common lab contaminants which should be < RL |
| Field Blank | One per batch of 20 or less | No target analytes ≥QL; with the exception of common field/laboratory contaminants | No corrective action by laboratory. | Data Validator | Bias / Contamination | No target analytes ≥QL; with the exception of common field/laboratory contaminants. |
| Surrogates | 6 per sample | Statistically derived limits. | (1) Re-prep and reanalyze for confirmation of matrix interference when appropriate. | Analyst, Laboratory Supervisor and Data Validator | Accuracy / Bias | Statistically derived limits |

| | | | | | | |
|---|---|---|---|---|---|---|
| Laboratory Control Spike | One per batch of 20 or less | Statistically derived from lab data or nominal limits depending on the project. Statistical limits are used as default limits. | (1) Evaluate and reanalyze if possible<br>(2) If an MS/MSD was performed in the same 12 hour clock and acceptable narrate.<br>(3) If the LCS recoveries are high but the sample results are <QL narrate otherwise re-prep and reanalyze. | Analyst, Laboratory Supervisor and Data Validator | Precision / Accuracy / Bias | Statistically derived from lab data or nominal limits depending on the project. Statistical limits are used as default limits. |
| Internal Standards | 6 per sample | Retention time ± 30 seconds; EICP area within -50% to +100% of last calibration verification (12 hours) for each IS. | Inspect mass spectrometer or GC for malfunctions; mandatory reanalysis of samples analyzed while system was malfunctioning. | Analyst, Laboratory Supervisor and Data Validator | Precision / Accuracy / Bias | Retention time ± 30 seconds; EICP area within -50% to +100% of last calibration verification (12 hours) for each IS. |
| Matrix spike / Matrix spike duplicate | One per SDG or every 20 samples | Statistically derived from lab data or nominal limits depending on the project. Statistical limits are used as default limits. | (1) CA will not be taken for samples when recoveries are outside limits and surrogate and LCS criteria are met<br>(2) If both the LCS and MS/MSD are unacceptable re-prep the samples and QC. | Analyst, Laboratory Supervisor and Data Validator | Precision / Accuracy / Bias | Statistically derived from lab data or nominal limits depending on the project. Statistical limits are used as default limits. |

**Title:** QAPP for Test Pit Investigation at Site 3 – Ninth Street Landfill

**Site Name/Project Name:** NAS JRB Willow Grove
**Site Location:** Willow Grove, Pennsylvania

**Revision Number:** 0
**Revision Date:** April 2007

| | |
|---|---|
| Matrix | Soil |
| Analytical Group | Pesticides |
| Concentration Level | Low/Medium |
| Sampling SOP | SA-1.3 |
| Analytical Method/ SOP Reference | SW-846 8081A/STL SOP PITT-GC-0001 |
| Sampler's Name | Don Whalen |
| Field Sampling Organization | Tetra Tech NUS, Inc. |
| Analytical Organization | STL Laboratories |
| No. of Sample Locations | 16 |

| QC Sample: | Frequency/Number | Method/SOP QC Acceptance Limits | Corrective Action | Person(s) Responsible for Corrective Action | Data Quality Indicator (DQI) | Measurement Performance Criteria |
|---|---|---|---|---|---|---|
| Method Blank | One per 20 samples or less | No target compounds ≥ 1/2 CRQL | Re-clean, retest, re-extract, reanalyze, and/or qualify data. | Analyst, Laboratory Supervisor and Data Validator | Bias / Contamination | No target compounds ≥ 1/2 CRQL |
| Field Blank | One per batch of 20 or less | No target analytes ≥ QL | No corrective action by laboratory. | Data Validator | Bias / Contamination | No target analytes ≥ QL. |
| Surrogates | 2 per sample | Statistically derived limits. | (1) Re-prep and reanalyze for confirmation of matrix interference when appropriate. | Analyst, Laboratory Supervisor and Data Validator | Accuracy / Bias | Statistically derived limits |
| Laboratory Control Spike | One per 20 samples or less | Statistically derived from lab data or nominal limits depending on the project. Statistical limits are used as default limits. | (1) Evaluate and reanalyze if possible. (2) If an MS/MSD was performed in the same 12 hour clock and acceptable narrate. (3) If the LCS recoveries are high but the sample results are <QL narrate otherwise re-prep and reanalyze. | Analyst, Laboratory Supervisor and Data Validator | Precision / Accuracy / Bias | Statistically derived from lab data or nominal limits depending on the project. Statistical limits are used as default limits. |

2192

| | | | | | | |
|---|---|---|---|---|---|---|
| Matrix spike / Matrix spike duplicate | One per SDG or every 20 samples | Statistically derived from lab data or nominal limits depending on the project. Statistical limits are used as default limits. | (1) CA will not be taken for samples when recoveries are outside limits and surrogate and LCS criteria are met. (2) If both the LCS and MS/MSD are unacceptable re-prep the samples and QC. | Analyst, Laboratory Supervisor and Data Validator | Precision / Accuracy / Bias | Statistically derived from lab data or nominal limits depending on the project. Statistical limits are used as default limits. |

**Title:** QAPP for Test Pit Investigation at Site 3 – Ninth Street Landfill

**Site Name/Project Name:** NAS JRB Willow Grove
**Site Location:** Willow Grove, Pennsylvania

**Revision Number:** 0
**Revision Date:** April 2007

| | |
|---|---|
| Matrix | Soil |
| Analytical Group | PCBs |
| Concentration Level | Low/Medium |
| Sampling SOP | SA-1.3 |
| Analytical Method/ SOP Reference | SW-846 8082/STL SOP PITT-GC-0001 |
| Sampler's Name | Don Whalen |
| Field Sampling Organization | Tetra Tech NUS, Inc. |
| Analytical Organization | STL Laboratories |
| No. of Sample Locations | 16 |

| QC Sample: | Frequency/Number | Method/SOP QC Acceptance Limits | Corrective Action | Person(s) Responsible for Corrective Action | Data Quality Indicator (DQI) | Measurement Performance Criteria |
|---|---|---|---|---|---|---|
| Method Blank | One per 20 samples or less | No target compounds ≥ ½ CRQL | Re-clean, retest, re-extract, reanalyze, and/or qualify data. | Analyst, Laboratory Supervisor and Data Validator | Bias / Contamination | No target compounds ≥ ½ CRQL |
| Field Blank | One per batch of 20 or less | No target analytes ≥ QL | No corrective action by laboratory. | Data Validator | Bias / Contamination | No target analytes ≥ QL |
| Surrogates | 2 per sample | Statistically derived limits. | (1) Re-prep and reanalyze for confirmation of matrix interference when appropriate. | Analyst, Laboratory Supervisor and Data Validator | Accuracy / Bias | Statistically derived limits |
| Laboratory Control Spike | One per 20 samples or less | Statistically derived from lab data or nominal limits depending on the project. Statistical limits are used as default limits. | (1) Evaluate and reanalyze if possible (2) If an MS/MSD was performed in the same 12 hour clock and acceptable narrate. (3) If the LCS recoveries are high but the sample results are <QL narrate otherwise re-prep and reanalyze. | Analyst, Laboratory Supervisor and Data Validator | Precision / Accuracy / Bias | Statistically derived from lab data or nominal limits depending on the project. Statistical limits are used as default limits. |

2192

| | | | | | | |
|---|---|---|---|---|---|---|
| Matrix spike / Matrix spike duplicate | One per SDG or every 20 samples | Statistically derived from lab data or nominal limits depending on the project. Statistical limits are used as default limits. | (1) CA will not be taken for samples when recoveries are outside limits and surrogate and LCS criteria are met<br>(2) If both the LCS and MS/MSD are unacceptable re-prep the samples and QC. | Analyst, Laboratory Supervisor and Data Validator | Precision / Accuracy / Bias | Statistically derived from lab data or nominal limits depending on the project. Statistical limits are used as default limits. |

| | |
|---|---|
| Matrix | Soil |
| Analytical Group | Dioxin/Furans |
| Concentration Level | Low/Medium |
| Sampling SOP | SA-1.3 |
| Analytical Method/ SOP Reference | SW-846 8290/STL SOP KNOX-ID-0004 |
| Sampler's Name | Don Whalen |
| Field Sampling Organization | Tetra Tech NUS, Inc. |
| Analytical Organization | STL Laboratories |
| No. of Sample Locations | 2 |

| QC Sample: | Frequency/Number | Method/SOP QC Acceptance Limits | Corrective Action | Person(s) Responsible for Corrective Action | Data Quality Indicator (DQI) | Measurement Performance Criteria |
|---|---|---|---|---|---|---|
| Method Blank | One per batch of 20 or less | No target compounds ≥1/2 CRQL except common lab contaminants which should be < RL. | Re-clean, retest, re-extract, reanalyze, and/or qualify data. | Analyst, Laboratory Supervisor and Data Validator | Bias / Contamination | No target compounds ≥1/2 CRQL except common lab contaminants which should be < RL |
| Field Blank | One per batch of 20 or less | No target analytes ≥QL; with the exception of common field/laboratory contaminants | No corrective action by laboratory. | Data Validator | Bias / Contamination | No target analytes ≥QL; with the exception of common field/laboratory contaminants. |
| Surrogates | 6 per sample | Statistically derived limits. | (1) Re-prep and reanalyze for confirmation of matrix interference when appropriate. | Analyst, Laboratory Supervisor and Data Validator | Accuracy / Bias | Statistically derived limits |

2192

| | | | | | | |
|---|---|---|---|---|---|---|
| Laboratory Control Spike | One per batch of 20 or less | Statistically derived from lab data or nominal limits depending on the project. Statistical limits are used as default limits. | (1) Evaluate and reanalyze if possible<br>(2) If an MS/MSD was performed in the same 12 hour clock and acceptable narrate.<br>(3) If the LCS recoveries are high but the sample results are <QL narrate otherwise re-prep and reanalyze. | Analyst, Laboratory Supervisor and Data Validator | Precision / Accuracy / Bias | Statistically derived from lab data or nominal limits depending on the project. Statistical limits are used as default limits. |
| Internal Standards | 6 per sample | Retention time $\pm$ 30 seconds; EICP area within -50% to +100% of last calibration verification (12 hours) for each IS. | Inspect mass spectrometer or GC for malfunctions; mandatory reanalysis of samples analyzed while system was malfunctioning. | Analyst, Laboratory Supervisor and Data Validator | Precision / Accuracy / Bias | Retention time $\pm$ 30 seconds; EICP area within -50% to +100% of last calibration verification (12 hours) for each IS. |
| Matrix spike / Matrix spike duplicate | One per SDG or every 20 samples | Statistically derived from lab data or nominal limits depending on the project. Statistical limits are used as default limits. | (1) CA will not be taken for samples when recoveries are outside limits and surrogate and LCS criteria are met<br>(2) If both the LCS and MS/MSD are unacceptable re-prep the samples and QC. | Analyst, Laboratory Supervisor and Data Validator | Precision / Accuracy / Bias | Statistically derived from lab data or nominal limits depending on the project. Statistical limits are used as default limits. |

| | |
|---|---|
| Matrix | Soil |
| Analytical Group | Metals |
| Concentration Level | Low/Medium |
| Sampling SOP | SA-1.3 |
| Analytical Method/ SOP Reference | SW-846 6010B/STL SOP PITT-MT-0001 |
| Sampler's Name | Don Whalen |
| Field Sampling Organization | Tetra Tech NUS, Inc. |
| Analytical Organization | STL Laboratories |
| No. of Sample Locations | 16 |

| QC Sample: | Frequency/Number | Method/SOP QC Acceptance Limits | Corrective Action | Person(s) Responsible for Corrective Action | Data Quality Indicator (DQI) | Measurement Performance Criteria |
|---|---|---|---|---|---|---|
| Method Blank | One per digestion batch of 20 or fewer samples | Less than 1/2 PQL | 1) Investigate source of contamination. Re-digest and reanalyze all associated samples if sample concentration ≥ QL and <10x the blank concentration. | Laboratory Supervisor | Bias / Contamination | Less than ½PQL |
| Field Blank | One per batch of 20 or less | No target analytes ≥ QL | No corrective action by laboratory. | Data Validator | Bias / Contamination | No target analytes ≥ QL |
| Laboratory Control Sample | One per digestion batch of 20 or fewer samples | Recovery within ± 20% of true value, unless vendor-supplied or statistical limits have been established. | 1) Investigate source of problem. 2) Re-digest and reanalyze all associated samples. | Laboratory Supervisor | Accuracy / Bias / Contamination | Recovery within ± 20% of true value, unless vendor-supplied or statistical limits have been established. |
| Duplicate Sample | One per digestion batch of 20 or fewer samples | RPD ≤20% for duplicate spikes. | Flag results. | Analyst, Laboratory Supervisor and Data Validator | Precision | RPD ≤20% for duplicate spikes |
| Matrix Spike | One per digestion batch of 20 or fewer samples | Recovery ± 25% of true value, if sample < 4x spike added. | Flag results. | Analyst, Laboratory Supervisor and Data Validator | Accuracy / Bias | Recovery ± 25% of true value, if sample < 4x spike added. |

2192

| | | | | | | |
|---|---|---|---|---|---|---|
| ICP Serial Dilution | One per digestion batch | If original sample result is at least 50x IDL, 5-fold dilution must agree within ± 10% of the original result. | Flag result or dilute and reanalyzed sample to eliminate interference. | Analyst, Laboratory Supervisor and Data Validator | Accuracy / Bias | If original sample result is at least 50x IDL, 5-fold dilution must agree within ± 10% of the original result. |

**Title:** QAPP for Test Pit Investigation at Site 3 – Ninth Street Landfill

**Site Name/Project Name**: NAS JRB Willow Grove
**Site Location:** Willow Grove, Pennsylvania

**Revision Number:** 0
**Revision Date:** April 2007

| | |
|---|---|
| Matrix | Soil |
| Analytical Group | Mercury |
| Concentration Level | Low/Medium |
| Sampling SOP | SA-1.3 |
| Analytical Method/ SOP Reference | SW-846 7471A/STL SOP PITT-MT-0007 |
| Sampler's Name | Don Whalen |
| Field Sampling Organization | Tetra Tech NUS, Inc. |
| Analytical Organization | STL Laboratories |
| No. of Sample Locations | 16 |

| QC Sample: | Frequency/Number | Method/SOP QC Acceptance Limits | Corrective Action | Person(s) Responsible for Corrective Action | Data Quality Indicator (DQI) | Measurement Performance Criteria |
|---|---|---|---|---|---|---|
| Method Blank | One per prep batch | No analyte detected > ½ PQL | (1) Investigate source of contamination.<br>(2) Report all sample results <PQL.<br>(3) Report sample results >10X the blank result and flag results with a "B".<br>(4) Reanalyze all other samples associated with the failing blank. | Laboratory Supervisor | Bias Contamination | No analyte detected >½PQL |
| Field Blank | One per batch of 20 or less | No mercury $\geq$ QL | No corrective action by laboratory. | Data Validator | Bias / Contamination | No mercury $\geq$ QL |
| Laboratory Control Sample | One per prep batch | 80-120 %R | (1) If the LCS fails high, report samples that are <QL.<br>(2) Recalibrate and/or reanalyze other samples. | Laboratory Supervisor | Accuracy / Bias | 80-120 %R |
| Duplicate Sample | One sample duplicate per 20 samples | RPD $\leq$20 for samples >3X the PQL | (1) Investigate problem and reanalyze sample in duplicate<br>(2) If RPD still >20, report original result with notation or narration. | Analyst, Laboratory Supervisor and Data Validator | Precision | RPD $\leq$20 for samples <3X the PQL and <100% for samples >3X the PQL |

2192

| | | | | | | |
|---|---|---|---|---|---|---|
| Matrix Spike | One for every set of 10 samples | 85-115% R if sample is < 4x the spike added | (1) If both the LCS and MS are unacceptable re-prep and reanalyze the samples and QC.<br>(2) For 7196, dilute a new pH adjusted aliquot, re-spike and reanalyze to confirm matrix interference; narrate. | Analyst, Laboratory Supervisor and Data Validator | Accuracy / Bias | 85-115%R |

**Title:** QAPP for Test Pit Investigation at Site 3 – Ninth Street Landfill

**Site Name/Project Name:** NAS JRB Willow Grove
**Site Location:** Willow Grove, Pennsylvania

**Revision Number:** 0
**Revision Date:** April 2007

| | |
|---|---|
| Matrix | Soil |
| Analytical Group | Cyanide |
| Concentration Level | Low/Medium |
| Sampling SOP | SA-1.3 |
| Analytical Method/ SOP Reference | SW-846 9012A/STL SOP PITT-WC-0018 |
| Sampler's Name | Don Whalen |
| Field Sampling Organization | Tetra Tech NUS, Inc. |
| Analytical Organization | STL Laboratories |
| No. of Sample Locations | 16 |

| QC Sample: | Frequency/Number | Method/SOP QC Acceptance Limits | Corrective Action | Person(s) Responsible for Corrective Action | Data Quality Indicator (DQI) | Measurement Performance Criteria |
|---|---|---|---|---|---|---|
| Method Blank | One per 20 samples or less | No target compounds ≥ CRQL | Re-clean, retest, re-extract, reanalyze, and/or qualify data. | Analyst, Laboratory Supervisor and Data Validator | Bias / Contamination | No target compounds ≥ CRQL |
| Field Blank | One per batch of 20 or less | No cyanide ≥ QL | No corrective action by laboratory. | Data Validator | Bias / Contamination | No cyanide ≥ QL |
| Surrogates | 2 per sample | 70-130% | (1) Re-prep and reanalyze for confirmation of matrix interference when appropriate. | Analyst, Laboratory Supervisor and Data Validator | Accuracy / Bias | 70-130% |
| LCS/LCSD | One per 20 samples or less | 75-125% | (1) Evaluate and reanalyze if possible. (2) If an MS/MSD was performed in the same 12 hour clock and acceptable narrate. (3) If the LCS recoveries are high but the sample results are <QL narrate otherwise re-prep and reanalyze. | Analyst, Laboratory Supervisor and Data Validator | Precision / Accuracy / Bias | 75-125% |

| | | | | | | |
|---|---|---|---|---|---|---|
| Matrix spike / Matrix spike duplicate | One per SDG or every 20 samples | 75-125% | (1) CA will not be taken for samples when recoveries are outside limits and surrogate and LCS criteria are met.<br>(2) If both the LCS and MS/MSD are unacceptable re-prep the samples and QC. | Analyst, Laboratory Supervisor and Data Validator | Precision / Accuracy / Bias | 75-125% |

## QAPP Worksheet #29

Identify the documents and records that will be generated for all aspects of the project including, but not limited to, sample collection and field measurement, on-site and off-site analysis, and data assessment.

☐ Worksheet Not Applicable (State Reason)

**Project Documents and Records Table**

| Sample Collection Documents and Records | On-site Analysis Documents and Records | Off-site Analysis Documents and Records | Data Assessment Documents and Records | Other |
|---|---|---|---|---|
| -Field Logbook<br>-Field Sample Forms<br>-Chain of Custody Records<br>-Air bills<br>-Sampling Instrument Calibration Logs<br>- Sampling Notes and Drilling Logs<br>-Photographs<br>-Field Task Modification Forms<br>-This QAPP<br>-Health and Safety Plan | -Field Sample Data<br>-Field Logbook<br>-Field Sample Forms<br>-Sampling Instrument Calibration Logs<br>-Field Sample Data<br>-Chain of Custody record/Form<br>-Field Task Modification Form | -Sample receipt, custody, and tracking record<br>-Standards traceability logs<br>-Equipment calibration logs<br>-Sample preparation logs<br>-Run logs<br>-Equipment maintenance, testing, and inspection logs<br>-Corrective action forms<br>-Reported field sample results<br>-Reported results for standards, qc checks, and qc samples<br>-Sample storage and disposal records<br>-Telephone logs<br>-Extraction/clean-up records<br>-Raw data (stored electronically) | -Field Sampling Audit Checklist<br>-Analytical Audit Checklist<br>-Data Review Reports<br>-Laboratory QA Plan<br>-Tabulated Data Summary Forms<br>-Data Validation Memoranda<br>-Performance Monitoring Report | |

2192

## QAPP Worksheet #30

Complete this worksheet for each matrix, analytical group, and concentration level. Identify all laboratories or organizations that will provide analytical services for the project, including on-site screening, on-site definitive, and off-site laboratory analytical work. If applicable, identify the subcontractor laboratories and backup laboratory or organization that will be used if the primary laboratory or organizations cannot be used.

☐ Worksheet Not Applicable (State Reason)

### Analytical Services Table

| Matrix | Analytical Group | Concentration Level | Sample Location/ID Numbers | Analytical SOP | Data Package Turnaround Time | Laboratory/ Organization (Name and Address, Contact Person and Telephone Number) | Backup Laboratory/Organization (Name and Address, Contact Person and Telephone Number |
|---|---|---|---|---|---|---|---|
| Soil | Volatiles | Low | See worksheet 18 | PITT-MS-0002 | Requested: 21 day<br>Actual: | STL Pittsburgh<br>301 Alpha Drive<br>RIDC Park<br>Pittsburgh, PA 15238<br>Veronica Bortot<br>412-963-7058 (phone)<br>412-963-2468 (fax) | Barb Hall<br>412-963-7058 (phone)<br>412-963-2468 (fax) |
| Soil | Semivolatile | Low | See worksheet 18 | PITT-OP-0001<br>PITT-MS-0001 | Requested: 21 day<br>Actual: | | |
| Soil | Pesticide | Low | See worksheet 18 | PITT-OP-0001<br>PITT-GC-0001 | Requested: 21 day<br>Actual: | | |
| Soil | PCB | Low | See worksheet 18 | PITT-OP-0001<br>PITT-GC-0001 | Requested: 21 day<br>Actual: | | |
| Soil | Dioxin/Furans | Low | See worksheet 18 | KNOX-ID-0004 | Requested: 21 day<br>Actual: | | |
| Soil | Metals | Low | See worksheet 18 | PITT-IP-0002<br>PITT-MT-0001 | Requested: 21 day<br>Actual: | | |
| Soil | Mercury | Low | See worksheet 18 | PITT-MT-0007 | Requested: 21 day<br>Actual: | | |
| Soil | Cyanide | Low | See worksheet 18 | PITT-WC-0018 | Requested: 21 day<br>Actual: | | |

**Title:** QAPP for Test Pit Investigation at Site 3 – Ninth Street Landfill

**Site Name/Project Name:** NAS JRB Willow Grove
**Site Location:** Willow Grove, Pennsylvania

**Revision Number:** 0
**Revision Date:** April 2007

## QAPP Worksheet #31

Identify the type, frequency, and responsible parties of planned assessment activities that will be preformed for the project.

☐ Worksheet Not Applicable (State Reason)

**Planned Project Assessments Table**

| Assessment Type | Frequency | Internal or External | Organization Performing Assessment | Person(s) Responsible for Performing Assessment (Title and Organizational Affiliation) | Person(s) Responsible for Responding to Assessment Findings (Title and Organizational Affiliation) | Person(s) Responsible for Identifying and Implementing Corrective Actions (CA) (Title and Organizational Affiliation) | Person(s) Responsible for Monitoring Effectiveness of CA (Title and Organizational Affiliation) |
|---|---|---|---|---|---|---|---|
| Health and Safety | 1 per contract year | Int. | TtNUS | TBD | PM | Auditor and Health and Safety Manager | Health and Safety Manager Matt Soltis |
| Laboratory Systems Audit | Every 18 months | Ext. | NFESC | TBD | Laboratory QA Manager | Laboratory QA Manager | Laboratory QA Manager |
| Field Sampling Systems Audit | 1 per contract year | Int. | TtNUS | TBD | PM | Auditor and QA Manager (Kelly Carper TtNUS) | QA Manager (Kelly Carper TtNUS) |

2192

## QAPP Worksheet #32

(UFP-QAPP Manual Section 4.1.2)
For each type of assessment describe procedures for handling QAPP and project deviations encountered during the planned project assessments.

☐ Worksheet Not Applicable (State Reason)

**Assessment Findings and Corrective Action Responses**

| Assessment Type | Nature of Deficiencies Documentation | Individual(s) Notified of Findings (Name, Title, Organization) | Timeframe of Notification | Nature of Corrective Action Response Documentation | Individual(s) Receiving Corrective Action Response (Name, Title, Org.) | Timeframe for Response |
|---|---|---|---|---|---|---|
| Health and Safety Audit | Audit checklist and written audit finding summary | Project Manager TtNUS, Field Operations Leader TtNUS, and Program Manager TtNUS | Dependant on findings, if major a stop work maybe issued immediately, however if minor within 1 week of audit | Written memo | Health and Safety Manager TtNUS, Auditor TtNUS, Program Manager TtNUS | Within 48 hours of notification |
| Field sampling system audit | Audit checklist and written audit finding summary | Project Manager TtNUS, Field Operations Leader TtNUS, and Program Manager TtNUS | Dependant on findings, if major a stop work maybe issued immediately, however if minor within 1 week of audit | Written memo | Quality Assurance Manager TtNUS, Auditor TtNUS, Program Manager TtNUS | Within 48 hours of notification |
| Laboratory systems Audit | Written audit report | Laboratory QA Managaer | Not specified by NFESC | Letter | NFESC | Specified by NFESC |

## QAPP Worksheet #33

Identify the frequency and type of planned QA Management Reports, the projected delivery date, the personnel responsible for report preparation, and the report recipients.

☐ Worksheet Not Applicable (State Reason)

### QA Management Reports Table

| Type of Report | Frequency (daily, weekly monthly, quarterly, annually, etc.) | Projected Delivery Date(s) | Person(s) Responsible for Report Preparation (Title and Organizational Affiliation) | Report Recipient(s) (Title and Organizational Affiliation) |
|---|---|---|---|---|
| Data validation report | Per SDG | Data Validation Manager or designee | Data Validation Manager or designee | PM (TtNUS), project file |
| Major analysis problem identification (Internal Memorandum) | When persistent analysis problems are detected | Immediately | QA Manager (TtNUS) | PM (TtNUS), QAM (TtNUS), Program Manager (TtNUS), project file |
| Project monthly progress report | Monthly for duration of the project | monthly | PM (TtNUS) | Navy, project file |
| Field progress reports | Daily, oral, during the course of sampling | everyday that field sampling is occurring | FOL (TtNUS) | PM (TtNUS) |
| Laboratory QA Report | When significant plan deviations result from unanticipated circumstances | immediately | Subcontracted laboratories | TtNUS, project file |

## QAPP Worksheet #34

Describe the processes that will be followed to verify project data. Verification inputs include items such as those listed in Table 9 of the UFP-QAPP Manual (Section 5.1). Describe how each item will be verified, when the activity will occur, and what documentation is necessary, and identify the persons responsible. *Internal* or *external* is in relation to the data generator.

☐ Worksheet Not Applicable (State Reason)

### Verification (Step I) Process Table

| Verification Input | Description | Internal/ External | Responsible for Verification (Name, Organization) |
|---|---|---|---|
| Sample Tables | Proposed samples verified to have been collected | Int. | FOL or designee TtNUS |
| Chain of custody | Chain of custody records will be reviewed internally by the Project Manager or designee and compared against sample tables listing the proposed samples to verify that all planned samples have been collected. | Int. | PM or designee TtNUS |
| Sample Coordinates | Sample locations have been verified to be correct and in accordance with the QAPP (overlay maps proposed locations against actual locations) | Int. | FOL, PM, or designee TtNUS |
| Data package | Verify that the data package contains all the elements required by TRRP-13 and the scope of work, this occurs as part of the data validation process. | Int. | Data validator TtNUS |
| Sample log sheets | Log sheets completed as samples are collected in the field are verified for completeness and are maintained at the project office. | Int. | PM or designee TtNUS |

## QAPP Worksheet #35

Describe the processes that will be followed to validate project data. Validation inputs include items such as those listed in Table 9 of the UFP-QAPP Manual (Section 5.1). Describe how each item will be validated, when the activity will occur, and what documentation is necessary and identify the person responsible. Differentiate between steps IIa and IIb of validation.

☐ Worksheet Not Applicable (State Reason)

**Validation (Steps IIa and IIb) Process Table**

| Step IIa/IIb | Validation Input | Description | Responsible for Validation (Name, Organization) |
|---|---|---|---|
| IIa | Data package | Validator will verify that elements of the data package that are required for validation are present and if not the lab will be contacted and the missing info will be requested. Validation will be performed as per worksheet 36. | Validator TtNUS |
| IIa | Field logs/sample coordinates | Verify that the sampling plan was implemented and carried out as written and any deviations are documented | PM TtNUS |
| IIa | Electronic Data | Verify all data have been transferred correctly and completely to the final SQL data base | PM or designee TtNUS |
| IIa | QAPP, SOPs/Field Logs, chains of custody | Verify that deviations have been documented and MPCs have been achieved. | PM, FOL, or designee TtNUS |

2192

## QAPP Worksheet #36

Identify the matrices, analytical groups, and concentration levels that each entity performing validation will be responsible for, as well as criteria that will be used to validate those data.

☐ Worksheet Not Applicable (State Reason)

**Validation (Steps IIa and IIb) Summary Table**

| Step IIa/IIb | Matrix | Analytical Group | Concentration Level | Validation Criteria | Data Validator (title and organizational affiliation) |
|---|---|---|---|---|---|
| IIa and IIb | Soil | Volatiles | Low | SW-845 8260B, USEPA National Functional Guidelines for Organic Data Review (September 1994) to the extent practicable, and QAPP Worksheets 12, 15, and 28. | TtNUS Staff Chemist |
| IIa and IIb | Soil | Metals/Mercury | Low | SW-845 6010B/7471A, National Functional Guidelines for Inorganic Data Review (April 1993) to the extent practicable and QAPP Worksheets 12, 15, and 28. | TtNUS Staff Chemist |
| IIa and IIb | Soil | Cyanide | Low | SW-845 9012A, USEPA National Functional Guidelines for Inorganic Data Review (April 1993) to the extent practicable and QAPP Worksheets 12, 15, and 28. | TtNUS Staff Chemist |
| IIa and IIb | Soil | Semivolatiles | Low | SW-845 8270C, USEPA National Functional Guidelines for Organic Data Review (September 1994) to the extent practicable, and QAPP Worksheets 12, 15, and 28. | TtNUS Staff Chemist |

## Validation (Steps IIa and IIb) Summary Table

| Step IIa/IIb | Matrix | Analytical Group | Concentration Level | Validation Criteria | Data Validator (title and organizational affiliation) |
|---|---|---|---|---|---|
| IIa and IIb | Soil | Pesticides | Low | SW-845 8081A, USEPA National Functional Guidelines for Organic Data Review (September 1994) to the extent practicable, and QAPP Worksheets 12, 15, and 28. | TtNUS Staff Chemist |
| IIa and IIb | Soil | PCBs | Low | SW-845 8082, USEPA National Functional Guidelines for Organic Data Review (September 1994) to the extent practicable, and QAPP Worksheets 12, 15, and 28. | TtNUS Staff Chemist |

## QAPP Worksheet #37

Describe the procedures / methods / activities that will be used to determine whether data are of the right type, quality, and quantity to support environmental decision-making for the project. Describe how data quality issues will be addressed and how limitations on the use of the data will be handled.

### Usability Assessment

**Summarize the usability assessment process and all procedures, including interim steps and any statistics, equations, and computer algorithms that will be used:**

For statistical comparisons and mathematical manipulations, non-detect values will be represented by a concentration equal to one-half the sample-specific reporting limit. Duplicate results (original and duplicate) will not be averaged for the purpose of representing the range of concentrations. However, the average of the original and duplicate will be used to represent the contaminant concentration detected at that sample location.

Statistical tests for outliers will be conducted using standard statistical techniques appropriate for this task. Potential outliers will be removed if a review of field and laboratory documents indicates that the results are true outliers. If no physical cause for a statistical outlier can be identified, the data point will not be removed from the data set. However, if the data point is found to truly represent a physical quantity that is different from the rest of the data set, it will be removed.

The suitability of any given statistical test will be assessed based on the completeness of the data sets and the conditions observed at the site. For example, when a single data value is available for soils or water samples at a given sampling location, statistical tests cannot be conducted for that individual sampling location. However, pooling of data across sampling locations may be possible and, if logical to do so, may be implemented at the discretion of the PM. Statistical testing will generally be conducted at the five percent significance level. Statistical testing at other significance levels may also be warranted to provide perspective on the results of testing at five percent significance. If other significance levels are used, they will be supported with rationales for their use

**Describe the evaluative procedures used to assess overall measurement error associated with the project:**

After all data evaluations are completed, any limitations on the use of data will be known and the limitations will be considered during decision making. If necessary, investigation objectives may be revised in anticipation of additional data collection in order to meet project quality objectives for the site.

After data validation and an overall review of data quality indicators, the data will be reconciled with MPCs to determine whether sufficient data of acceptable quality are available for decision making. A series of inspections and statistical analyses will be performed to estimate several of the data set characteristics. The statistical evaluations will include simple summary statistics for target analytes, such as the maximum concentration, minimum concentration, number of samples exhibiting no detectable analyte, the number of samples exhibiting detectable analytes, and the proportion of samples with detectable and undetectable analytes.

**Identify the personnel responsible for performing the usability assessment:**
One hundred percent of the laboratory data from chemical analyses will be validated. Validation of analytical data will be conducted by TtNUS. Final review and approval of validation deliverables will be completed by the DVM. VOC, SVOC, pesticides, PCBs, metals, and cyanide results will be validated according to the requirements of the National Functional Guidelines for Organic and Inorganic Data Review (USEPA, 1999 and 2004) including USEPA Region 3 Modifications.

**Describe the documentation that will be generated during usability assessment and how usability assessment results will be presented so that they identify trends, relationships (correlations), and anomalies:**

The data will be presented in a tabular format. The usability assessment is designed to:

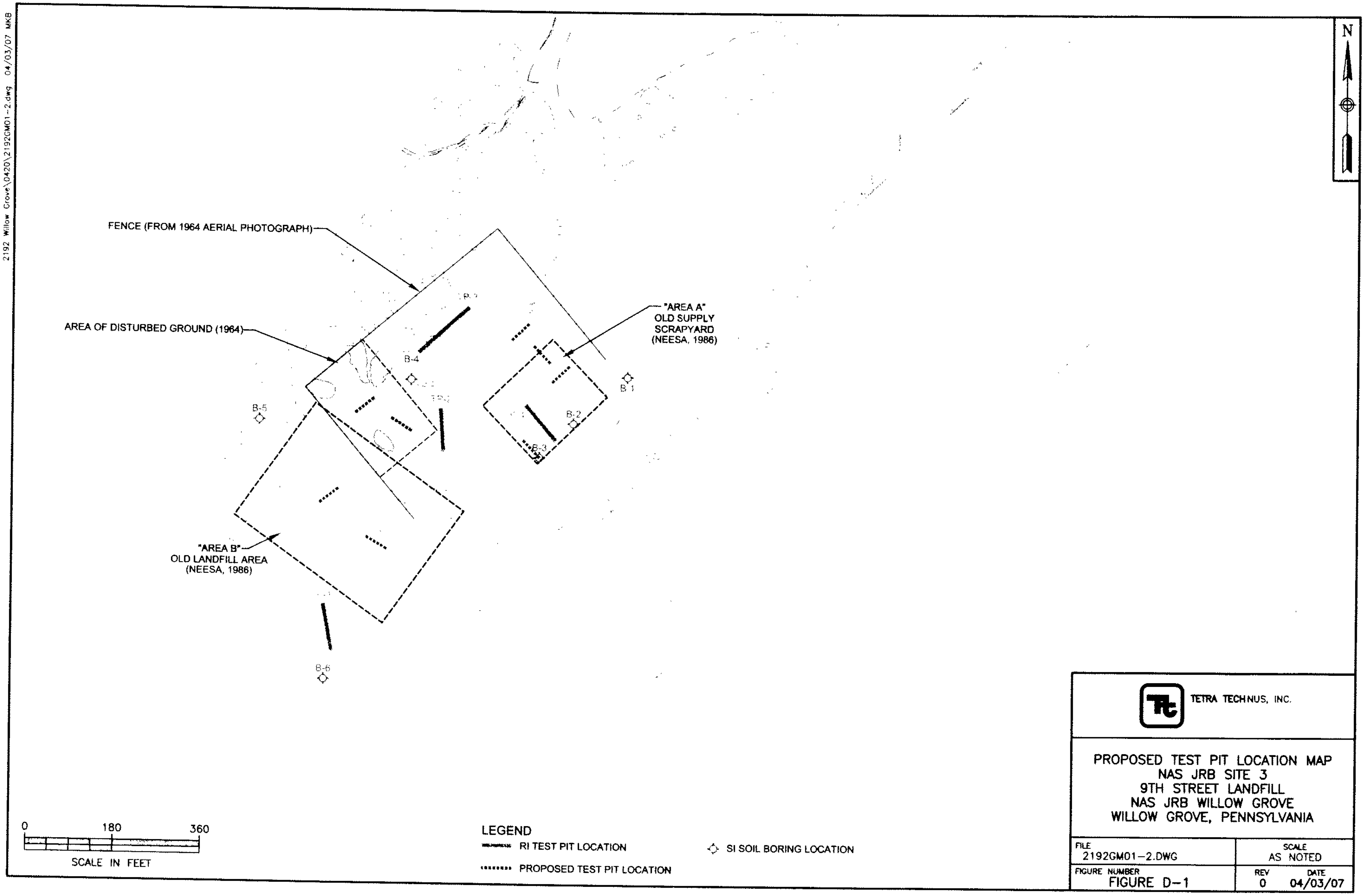
- Identify deviations, if any, from the field sampling SOPs.
- Identify deviations, if any, from the laboratory analytical methods.
- Identify deviations, if any, from the QAPP.
- Identify deviations, if any, from the data validation process.
- Evaluate effects of the above-listed deviations from planned procedures and processes on the interpretation and utility of the data using statistics, as applicable.
- Identify elevated detection limits and explain their impacts on the attainment of project objectives.
- Identify unusable data (i.e., data qualified as "UR" and "R").
- Evaluate project assumptions.
- Characterize data set distributions (e.g., Shapiro-Wilk W test) if enough data are available.
- Identify unanticipated data set characteristics such as a laboratory variance greater than the sampling variance (i.e., ANOVA, *t*-test) if enough data are available.

# APPENDIX C

# LABORATORY STANDARD OPERATING PROCEDURES

# APPENDIX D

# FIGURES




2192 Willow Grove\0420\2192GM01-2.dwg 04/03/07 MKB

TETRA TECH NUS, INC.

PROPOSED TEST PIT LOCATION MAP
NAS JRB SITE 3
9TH STREET LANDFILL
NAS JRB WILLOW GROVE
WILLOW GROVE, PENNSYLVANIA

| FILE | SCALE |
|---|---|
| 2192GM01-2.DWG | AS NOTED |
| FIGURE NUMBER: FIGURE D-1 | REV: 0 DATE: 04/03/07 |